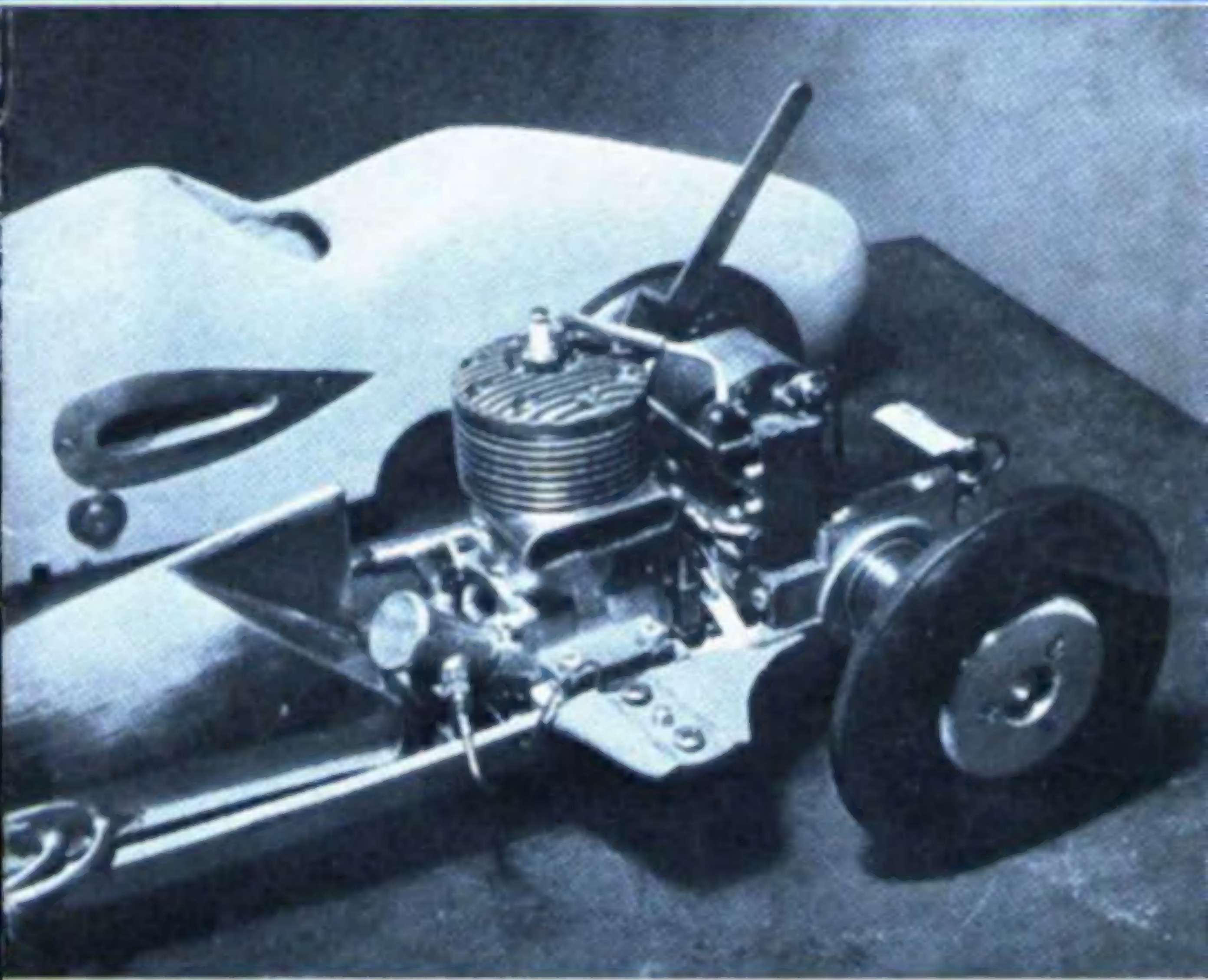
THE MODEL ENGINEER



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THE MODEL ENGINEER

EVERY THURSDAY

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Our Cover Picture

Model car racing is now very popular in many countries, and the photograph reproduced here shows an example of a 10 c.c. car built in Italy, where interest in full-size racing cars and their design has always been very keen, and is reflected in the excellent design and workmanship of the models. We have no exact particulars of the performance of this particular model, but it seems clear that development has taken place on very similar lines to that in this country and America. The engine follows the usual practice, being a short-stroke big-ported two-stroke with rotary admission valve and plain straight-through carburettor, but unlike most British and American engines, which nowadays favour glow-plug ignition, this uses the orthodox spark system, with direct-driven high-tension magneto. Transmission is by bevel gears to the rigidly-mounted ball bearing front axle. It would appear that the chassis or at least its lower part, is a one-piece casting, not an uncommon practice in these models, and the usual stopping lever is fitted, operating a stopcock in the fuel feed line.

SMOKE RINGS

Dan Hollings's "Century"

WE WERE interested and pleased to note that the November issue of the West Riding Small Locomotive Society's "Bulletin" bore the number "100." In the eight and a half years during which this monthly news-sheet has been produced, it has been the work of Dan Hollings, who has been the indefatigable hon. secretary of the society throughout that time.

We note that he desires to retire from that important post, and we know that his fellow-members received that request with much regret. But there must be many who feel that he richly deserves a rest from the unremitting devotion to duty which is so very characteristic of him.

We are sure that the members of the W.R.S.L.S. will not allow the occasion to pass without due recognition, though from our personal acquaintance with Mr. Hollings, we share the regret at his decision to retire. But in spite of all the time and care which he has devoted to his duties as secretary of the society and producer of its "Bulletin." he has built some very nice 3½-in. and 5-in. gauge locomotives. We hope that when he is released from executive duties he will be able to enjoy many more years of locomotive building.

Derby Works Training School

THE PROPER training of the prospective engineer is a matter that has always been of the utmost importance, and we are sometimes asked by parents of our younger readers if we can give some advice regarding training schools. There are excellent training schemes in operation for railway apprentices, and we know, from our own observation that there is a splendidly equipped Training School at the Derby Works, British Railways, Midland Region, Locomotive Department. It was founded in 1946 and is now generally acknowledged, in engineering circles, to be of outstanding efficiency.

We have lately received a copy of a 32-page illustrated brochure dealing with apprenticeship with British Railways, and we find it extremely interesting and informative. It gives details of the training undertaken at the school, and we understand that a copy will be sent to any parent or educational authority who enquires about the apprenticeship training scheme. The training is thorough and very comprehensive, and each boy who starts as a trainee is given a copy so that he may fully understand the course of training which he will undergo.

Applications for copies should be made to the Public Relations and Publicity Officer, British Railways, London Midland Region, Euston House, London, N.W.1.

Another Centenarian

IN A recent issue of the *Sussex Express and County Herald*, there was an account of a steam engine which must be about 150 years old. This fine old engine is now idle, having just been replaced by electrical machinery for turning heavy grinding mills and other plant at the Glynde lime works of G. Newington & Co. Ltd., the lime burners of Lewes, Sussex; but it is, at present, complete and in working order.

We learn that the most noticeable feature of this engine was, and is, the flywheel, 10 ft. in diameter and made in two halves bolted together, its weight being estimated at 1 ton. The normal speed of revolution, when the engine was working, was 45 to the minute. The engine is of the single-cylinder type, the diameter of the bore being 16 in. and stroke just under 3 ft. With a boiler pressure of 30 lb. p.s.i., the engine developed about 50 h.p.

There is no record of when or by whom it was made; but under the lower millstone of the grinding machine there is a plate bearing the name of E. Hubbard, millwright and engineer, of Lewes, and the date 1824. It is probable that this firm installed the engine at the same time. This means that the engine has been in continual use for 130 years.

Model Power Boat News

BY MERIDIAN

WINTER ACTIVITIES

FOR model power boat exponents, the winter months afford an opportunity of spending some time in the workshop.

In order to keep a competition boat up to peak performance in the summer, workshop time is often used up in repairs and maintenance—especially in the case of racing boats.

For this reason, boats in course of construction usually show more progress in the winter, and I know of several examples " on the stocks " at the present time. These include both racing hydroplanes and prototypes, and I look forward to seeing the result of the winter efforts at some of the regattas next season.

Four-stroke Revival ?

In spite of the present predominance of two-stroke engines as the motive power for racing boats, the past season has shown a slight increase in the number of four-stroke engined craft contesting some of the races, and at least two of the aforementioned boats under construction will have four-stroke engines installed.

It is to be hoped that this trend will continue towards more of a balance between the two types of i.c. engine, as there is nothing like a little variety to keep up the interest. It cannot be denied that present-day two-strokes tend to follow a similar design, which although having high performance, is perhaps, not as interesting as other designs or types of engine.

" Betty " and " Faro "

Two of the best-known four-stroke jobs of the pre-war period, namely, J. Innocent's *Betty* and K. William's *Faro* are still running with hulls of the submerged propeller type, but there is reason to think that if either of these engines were fitted in a really good fully-surfacing or " prop-riding " hull some startling results might be achieved.

It would not surprise me if both of these engines are not developing more power than the current two-strokes of similar capacity, and in support of this idea, one could quote the performance at Wicksteed a couple of seasons ago, of *Betty*, which achieved a run very close to the 60 m.p.h. mark, running with the propeller *fully submerged*. Sometimes on choppy water both *Betty* and *Faro* will, indeed, emulate the more modern mode of planing, but in general, they have to be regarded as non or semi-surfacing boats.

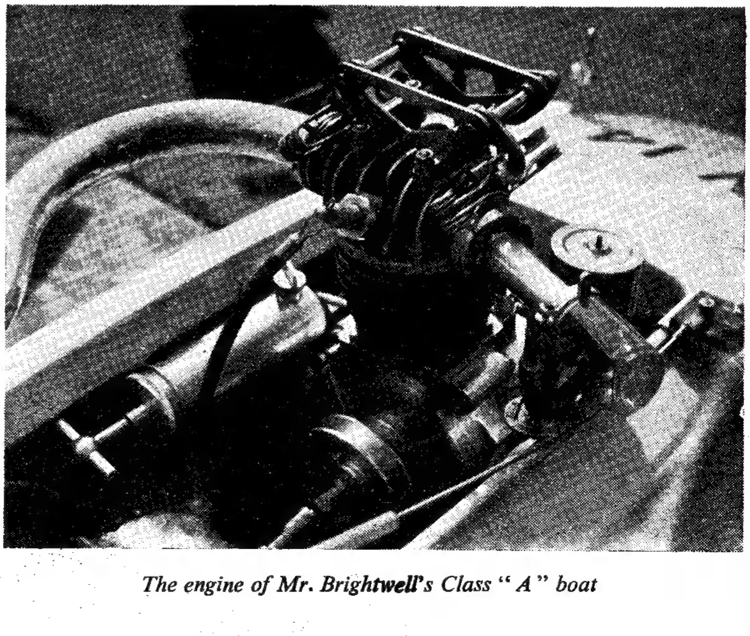
60 m.p.h.

Further support for the four-stroke is provided by the showing of Mr. Brightwell's Class " A " boat, which has beaten 60 m.p.h. several times during 1953. The engine was completed, I believe, in 1935, and although showing signs of speed when installed in a hydroplane, the hull suffered from the effects of instability, and few good runs were obtained. About 18 months ago, however, the engine was taken off the shelf of the workshop and installed in the present surfacing hull, with immediate success.

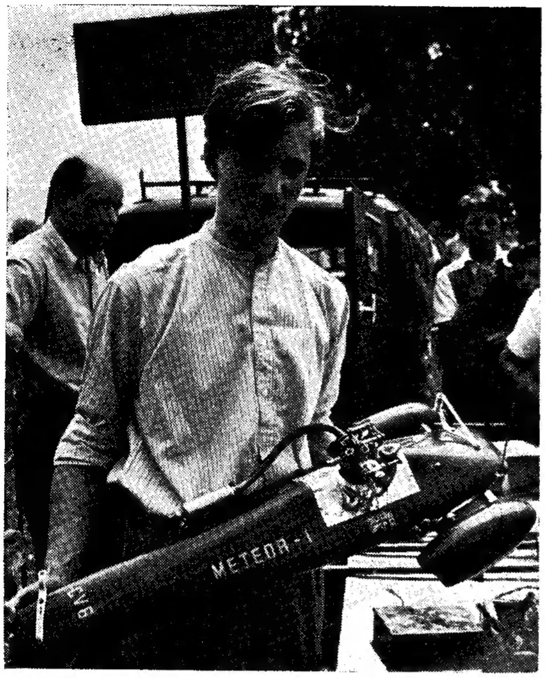
I am often asked if four-stroke engines can be run on glow-plugs. The answer, is, of course, " yes," but a certain amount of experiment may be necessary in the matter of compression ratio and fuels. The mixture range on which the engine will continue to run is narrower than a two-stroke when using glow-plugs, and the accumulator lead may have to be kept on until the engine is hot and revving at high speed. Mr. A. Rose formerly of Coventry, but now of the Bristol Club, used a fuel mixture of methanol and 5 per cent. nitro-benzine for his 15 c.c. four-stroke job *Meteor I.* I understand that the nitro-benzine did not improve the speed, but assisted in the starting, and helped to prevent fading out during the course of a run. Glow-plugs have proved very successful on this engine.

The Late J. B. Skingley

The sudden passing of Jack



The engine of Mr. Brightwell's Class " A " boat



Mr. A. Rose with his " B " class boat " Meteor I "

Skingley, of the Victoria M.S.C., will be felt deeply by all power boat men, and especially by those colleagues who were able to see, at close hand, his work on behalf of the model power boat movement.

Older readers of THE MODEL ENGINEER will remember his early work, jointly with his brother Arthur, when the petrol-engined hydroplane *Cissie* was a frequent runner in various speed events. This boat had an honourable and successful career, being one of the " few " in the early days of i.c. racing engines, when flash steam was far in front in terms of speed. Although *Cissie's* top speed was not high by present-day standards, it could always be reiied upon put up a good show, and can certainly be ranked as one of the pioneer i.c.-engined hydroplanes.

A Prize Winner

Shortly after the 1939-45 war, the river launch *Josephine* was commenced, and when completed was a very fine job indeed. The power plant was a 4-cylinder " Seal Major " engine, and, due to workmanship of high order, this engine turned out to be very successful. It started easily, and ran with plenty of power in hand. *Josephine* figured frequently in the prize lists, as reference to regatta reports will show, and at the 1953 Grand Regatta collected two prizes—third in the steering, and runner-up in the prototype competition. To do this in competition with about 85 other boats speaks volumes, for both performance and workmanship.

In the 1930s an electrical timing apparatus was designed and built, and this has been used at various other places besides Victoria Park, when accurate timing was necessary for circular-course racing. The apparatus works a 1/100th sec. stop-watch for direct reading, and also a tape recorder for permanent record. This apparatus has timed many record-breaking runs in the past, and is still working perfectly. Mr. Skingley was a familiar figure at regattas held at Victoria Park, generally acting as chief time-keeper, and his decisions were absolutely fair and never queried.

At a meeting of the Victoria M.S.C. held on December 21st, 1930, Mr. Skingley was elected honorary secretary of the club and discharged this duty up to the end—nearly 23 years of service. He was also a prominent official of the M.P.B.A., being chairman for many years and latterly vice-chairman. As a result of his able administration, the Victoria M.S.C. is able to boast of one of the largest memberships in the country for a purely power boat club.

Both the Victoria M.S.C. and the M.P.B.A. have suffered a grievous loss by his passing, but his work on behalf of model power boats will not be easily forgotten.

I am glad to say that Mrs. O. Skingley, who is almost as well known to power boat people as her late husband, will not be severing her connection with the Victoria Club, and, at a later date, may be able to help a little with the administration.

I would like to pass on to her, from all power boat enthusiasts, our most sincere and deepest sympathy.

The M.P.B.A.

Just a note to remind all members of model power boat clubs of the forthcoming annual general meeting of the Model Power Boat Association, to be held on January 23rd. Many important matters, of interest to both speed and prototype enthusiasts, will come up for discussion at this meeting.

A photograph of Mr. and Mrs. Skingley, with the "Seal Major" 30 c.c. engine, taken shortly after its completion

L.B.S.C.'s *Titfield Thunderbolt*

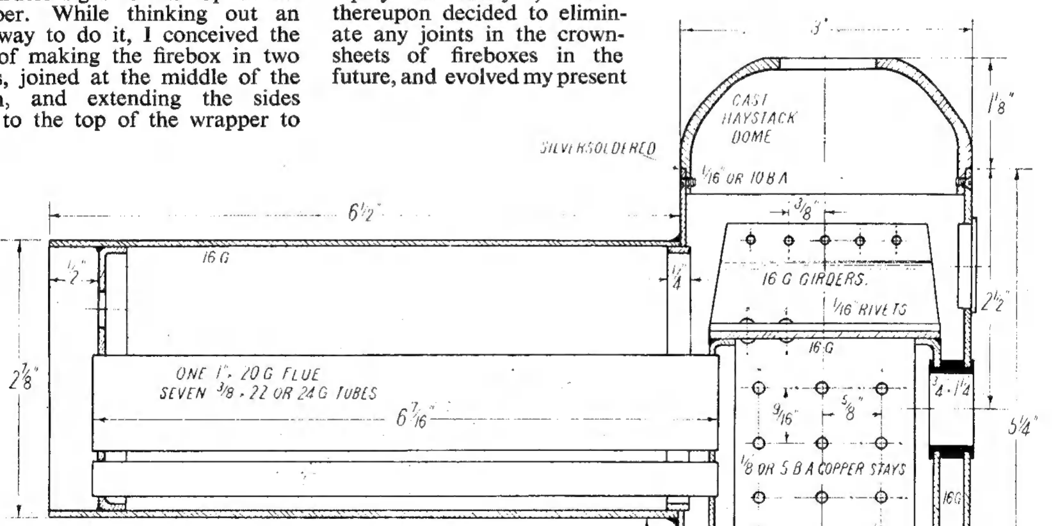
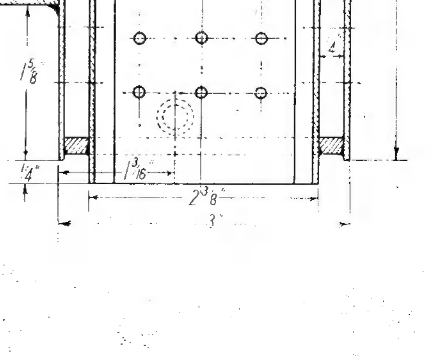
IN $3\frac{1}{2}$ AND 5 INCH GAUGES

BEFORE describing the boilers for the *Titfield Thunderbolt*, I would like to call attention to a little bit of ancient history, and sound a warning. The first boiler for my old *Ayesha* was built in five evenings, and I had not then had the experience of small boiler-smithing that I have since acquired; but I knew about the wastage of long rod stays, and so adopted girders. These, however, were not extended to the crown of the wrapper sheet; the foundation ring carried all the stress. Nevertheless, the boiler did all required of it, and it lasted many years. Soon after the old engine took the road, I heard of the crownsheet of a boiler collapsing, owing to failure of rod stays; and as I was then building another engine, a 4-6-0 with narrow firebox, I thought it would be a good wheeze to extend my girders right to the top of the wrapper. While thinking out an easy way to do it, I conceived the idea of making the firebox in two pieces, joined at the middle of the crown, and extending the sides right to the top of the wrapper to form a girder. This was done, and I wrote a short article for this journal, which was published, along with a diagram of the firebox and girder combined, before the "Live Steam" notes made their appearance. I forget the date, but any readers who have the volumes dated around 1921, might look it up if they need confirmation.

The 4-6-0 was duly completed, and I started on another engine with a wide firebox like *Ayesha*. As the narrow firebox with the joint in the crown seemed to be doing well, I thought I would elaborate the idea, so as to enable two girders to be fitted, and got out the scheme shown in the accompanying illustration. Before making the firebox on this principle, I made a thorough examination of the one with the single girder, and gave it another test by water pressure. Now although it had stood up to the original water test, it showed signs of distortion at each side of the joint, on the second; and this aroused my suspicions that the boiler would eventually fail at the seam, where the expansion and contraction stresses took full effect. If there is one thing that Curly never fails to do, it is "play for safety"; so I thereupon decided to eliminate any joints in the crownsheets of fireboxes in the future, and evolved my present system of staying, with the girders outside the crownsheet altogether.

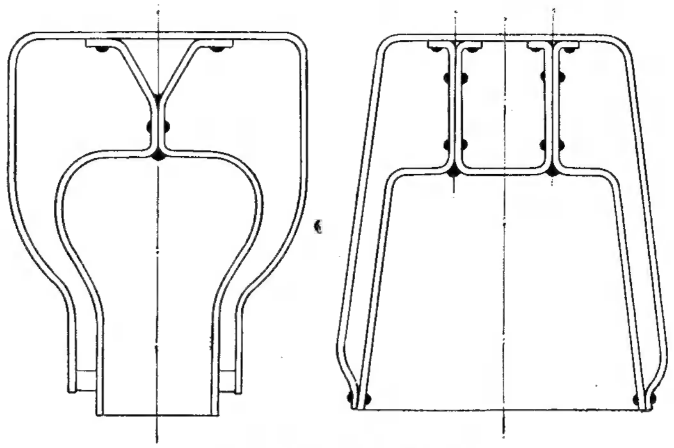
After Thirty Years!

They say that history repeats itself; and so I was rather intrigued to see my old idea presented in a slightly different form, in a recent article by another writer in this journal, who at one time used to correspond with me. Everybody is, of course, entitled to his—or her—own opinions; and personally I would prefer the method of construction that I originally schemed out, as the parts are held by rivets, while the brazing, or bronze-welding, is being carried out. Copper, when heated for brazing or bronze-welding, will distort; for "official" confirmation, if needed, there are explanations in the British Oxygen Company's book "Copper and Bronze Welding,"

Longitudinal section of boiler for the $3\frac{1}{2}$-in. gauge "Titfield Thunderbolt"

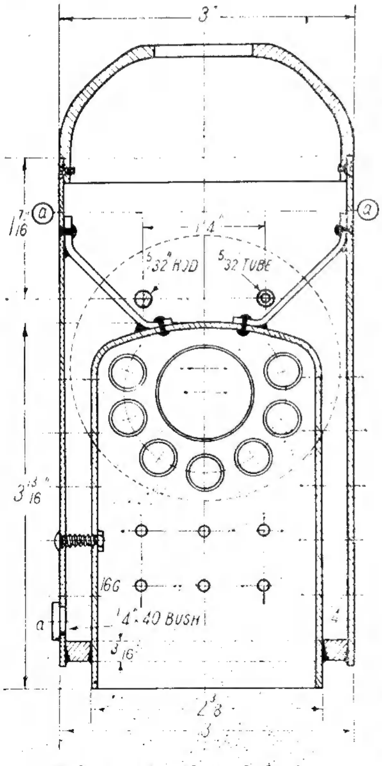
on how to deal with joints that distort when being operated on. The same kind of trouble is frequently mentioned in the Sifbronze people's quarterly journal "Sif-Tips," and hints given on how to overcome it. It is, therefore, logical to assume that if a boiler is assembled with unriveted joints, distortion will take place under the heat of the blowpipe; and tack-welding won't solve the problem, for the reason that tack-welding itself is a cause of distortion, occasioned by the fierce local heat needed for the job. A boiler made on the principle recently illustrated, would probably look somewhat different "in the flesh"—or rather metal—from what it does on paper.



Discarded over thirty years ago!

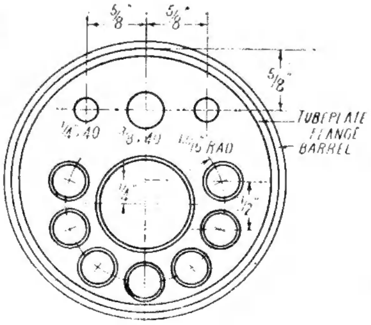
Years of Experience

I purchased my "Alda" oxy-acetylene outfit in March, 1932, which gives me nearly 22 years' actual personal experience in bronze-welding little locomotive boilers; before that, I used a blowlamp. The boilers I now design (and in some cases build) are the result of that experience. I have tried, by a process of trial and error, to produce boiler designs that can be carried out by any Tom, Dick or Harry—or Tess, Doris and Harriet, if they feel inclined—without constructional troubles; and which, with average workmanship, *will be perfectly safe when completed.* Nuff sed!



Cross section through firebox

One word *re* firebox stays. I hope nobody who builds one of my boilers, will ever be tempted to use plain stays fixed by any "brazing" material with a phosphorous content. Such material is far too brittle, as I have explained several times, for use in boiler work. A test such as recently described, is misleading, for the following reason. Put a strip of tin in the vice, attach a lever to one end, and see if you can tear the tin apart by a straight pull. Even if you manage it, the power needed will be considerable. Now take another similar bit in your fingers, and without the aid of any lever or anything else, bend it back and forth a few times, and it will promptly fall apart. The expansion and contraction stresses in a locomotive firebox have exactly the same effect; not only that, but the plain stays, under the action of the molten metal, will themselves become brittle at the point where they pass through the plates. This even happens with silver-solder.

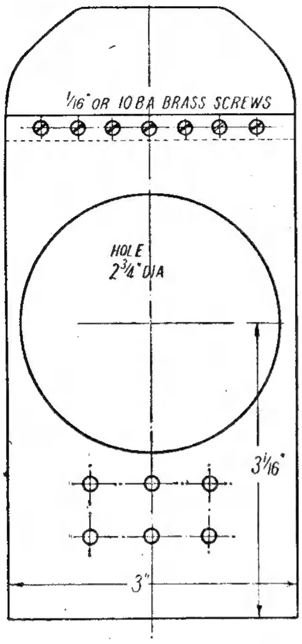


Smokebox tubeplate

The best *and safest* method of staying a firebox, is to screw the stays through both plates, rivet over on the outside, and put nuts on the inside. *This is the method used on British Railways standard locomotives.* If the threads are a good fit, nothing further is required. If not, soft solder is a perfectly satisfactory caulking, and the stays are not rendered brittle by their ends amalgamating with molten jointing material. Need I say more?

Something Different

The *Titfield Thunderbolt* has a type of boiler that I have never before described in these notes, so maybe a few words of explanation may not come amiss, ere we get down to the actual construction. The barrel is just a plain cylinder, unadorned with any excrescences; but the firebox is of the Gothic or "haystack" pattern, beloved of the old-time designers, on account of the extra steam space which it provided. I thought of several different ways of making the shell for the boiler, and finally decided that the method shown would be the easiest and safest. As you'll see, the throatplate and sides of the firebox casing are made in one piece; the barrel is attached to the front of the casing by a brazed "piston-ring" joint. The backhead is the usual flanged plate, side flanges only being needed; bushes are provided for the fittings. To save the trouble of making the square domed top from plate material, I am specifying a casting. In the ordinary course of events, I don't use castings in



Front end of firebox casing

boiler work, except for mountings; but in the present instance, where the casting is only really a glorified dome, its use is quite in order. The flange on top, for carrying the plate which serves as a manhole cover and also accommodates the safety-valves, can easily be machined truly with the casting held in the four-jaw chuck; and the rebates all around the lower part, which is spigoted into the sheet-metal casing, can be end-milled in the lathe, by the same method as used for axleboxes. If the casting is clean, they may only need cleaning up with a file. The casting can be made substantial enough to dispense with any staying.

The inside firebox is of the usual type, but rectangular; the crown is supported by my pet girders, but they are splayed out and attached to the upper part of the sides of the casing, eliminating the rod staying used on Belpaire wrapper sheets. The drawings show the arrangement for the $3\frac{1}{2}$-in. gauge engine; the 5-in. will be a little different, on account of the larger size. The work entailed in building the boiler, is no more difficult than the ordinary type; and the smaller one can be brazed with a $2\frac{1}{2}$-pint blowlamp, or an equivalent gas blowpipe, if nothing larger is available. To simplify matters, I'll deal with the boilers separately, taking the smaller one first.

Barrel and Firebox Casing

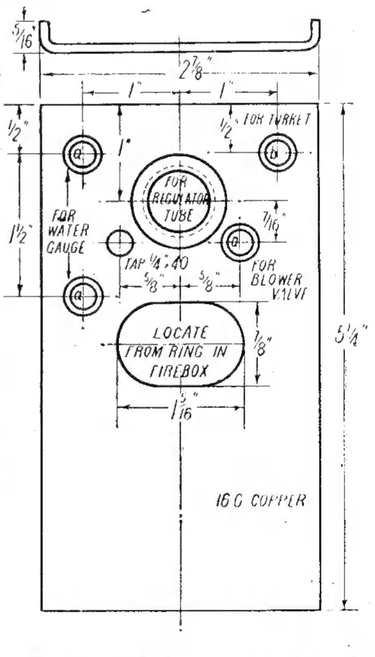
The barrel is a piece of 16-gauge seamless copper tube, $2\frac{7}{8}$ in. outside diameter, squared off in the lathe to a length of $6\frac{1}{2}$ in. Note, 18-gauge tube will do just as well, if you happen to have that gauge handy, and want to use it. The barrel can also be rolled up from 16- or 18-gauge sheet copper, and the joint made by lapping one edge over the other, for about $\frac{1}{4}$ in. and putting a few $\frac{1}{16}$-in. copper rivets through.

The firebox casing needs a sheet of 16-gauge copper measuring 9 in. × $5\frac{1}{4}$ in. This is bent to a channel shape, with 3 in. sides; a job that can be done in the same way as described for the *Britannia* casing. Leave the corners slightly rounded. Scribe a circle on the front, $2\frac{3}{4}$ in. diameter, the centre being $3\frac{1}{16}$ in. from the bottom; cut out the hole with a piercing saw, or by drilling holes all around, and breaking the piece out, then filing up the rough edges. If any reader can beg, borrow, or—ah, hum ! otherwise get hold of one of those gadgets used by plumbers for cutting holes in tanks, which is used in a hand-brace, it would be just the cat's feelers for doing the job. Lubricate it with the stuff used for turning steel; incidentally I'm still using "Cutmax" (the successor to "Houghtolard") diluted with an equal bulk of ordinary paraffin. It keeps my machine-tools literally merry and bright.

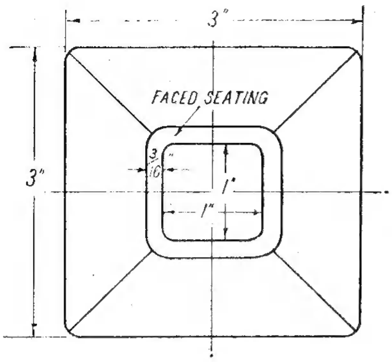
Make a "piston-ring" from $\frac{1}{16}$-in. sheet copper, about $\frac{1}{8}$ in. wide, and fit it in the hole; then put the barrel over it, and braze the joint. See that the contact surfaces are perfectly clean; that will apply to every joint in the boiler, so "take it as read" if I don't mention it again. Make sure that the barrel tube is fair and square all ways, with the firebox casing. Up-end it in a pan of coke, and pile the coke all around it, almost up to the joint. Cover with wet flux, such as Boron compo mixed to a paste with water, for ordinary brazing. Get your blowlamp going good and strong, heat the metal all around the joint, to dull red, then concentrate on one place until bright red, and apply some easy-running strip to the joint, in the flame. If hot enough, it will melt and run. Then work the flame slowly all around, feeding in the brazing material as you go, and allow enough to flow on to form a fillet. When arriving back at the starting point, give an extra blow-up, to ensure that the starting and finishing ends properly intermingle.

Several newcomers to our craft have lately written to ask if materials such as "Sifbrass," "Brazotectic," etc., are suitable for the job, and can they be used with a blowlamp or air-gas blowpipe. Yes; any material which melts fairly readily, and doesn't have a phosphorous content, can be used. Soft brass wire makes a good brazing material; and granulated spelter makes good joints, but it should be of the grade suitable for copper. There is a grade used for steel tube brazing, which needs a heat that would burn copper. By the way, don't confuse "Brazotectic" with "Cuprotectic"; the latter is unsuitable, as I stated many moons ago, for unriveted joints which have to withstand expansion and contraction stresses.

I have fully explained, in previous articles, how to use oxygen apparatus, for the benefit of those lucky readers who possess it; I wrote a long dissertation on Sifbronzing boilers when the offices of this journal were at Farringdon Street. As those readers are still in the minority, there is no need to detail it all again for the job in hand. Incidentally, I never have the slightest trouble in getting Sifbronze, or its counterparts, to run clean through my boiler joints. Those few good folk who saw the boiler shell of my *Britannia* before any "inside" was fitted, can confirm that ! !

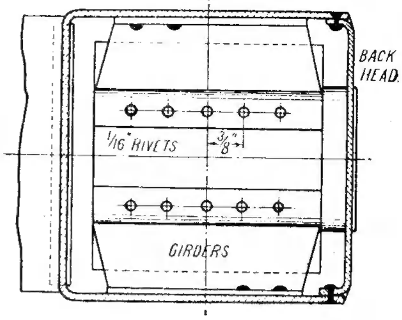


Backhead (firebox stays not shown)



Left—Plan of dome

Right—Section of firebox casing at (a) (a)



If a rolled-up-and-riveted boiler barrel has been used, the seam can be brazed after the job mentioned above, by laying the boiler shell in the pan, piling the coke around it, and proceeding in much the same manner. The flux should have been applied at the same time as it was put around the circumferential joint. Start at the outer end, work your way along, making sure that the rivet heads are well covered, and when you arrive at the throatplate joint, see that the brazing material melts and forms an unbroken surface. Let the job cool to black, then quench out in a pickle made from 1 part of commercial sulphuric acid, to about 16 of water. Leave it in for about 15 minutes or so, then fish it out, and wash well in running water. Clean it with a handful of steel wool, or some domestic scouring powder. I've briefly repeated these instructions at the request of a few new readers who are on their first boiler job.

Firebox and Crown Stays

This firebox is about the simplest that I have ever specified. For the firebox former plate, cut out a piece of $\frac{1}{4}$-in. steel, $2\frac{1}{8}$ in. × $3\frac{3}{4}$ in. round off the top as shown in the drawing of firebox, and round off one edge, so as to get a rounded flange on the firebox ends. It is quite probable that our approved advertisers will supply cast formers, as they have done for other engines in this series; it's worth the small charge, to save labour. Set out the location of the tube holes on the former, and drill a $\frac{1}{8}$-in. hole at each point.

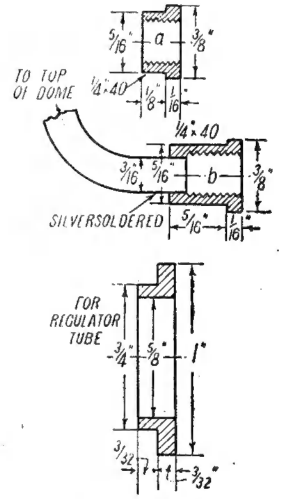
The copper plates should be 16-gauge; lay the former on the copper, scratch a line around the sides and top, about $\frac{5}{16}$ in. away, cut out, anneal, and flange over the edges of the former, in the manner I have described goodness-knows-how-many times already. Run the drill through the first plate, using the holes in the former as guide, before removing it from the former. Open out the tube holes with a 23/64-in. drill, and ream $\frac{3}{8}$ in., but don't put the reamer in too far. Drill the hole for the flue with 31/32-in. drill, and if you haven't a 1-in. reamer, very carefully file the hole until a 1-in. tube will fit tightly.

The second plate will need the hole for the firehole-ring cut in it. Make the ring from a $\frac{1}{2}$-in. slice of $1\frac{1}{4}$-in. × $\frac{1}{8}$-in. copper tube. Chuck in three-jaw and turn a step $\frac{1}{16}$ in. deep and $\frac{1}{8}$ in. long, on each end. Anneal, and squeeze oval in the bench vice. Lay the oval on the firebox plate, with the centre of it $\frac{3}{4}$ in. from the top of the flange; scratch a line all around, cut out the piece, clean the ring and the plate, push one of the flanges of the ring through the hole, from the side of the plate opposite to the flange, and beat the flange of the ring outwards and downwards until it lies close against the plate, and the latter is gripped hard against the shoulder of the ring. This is shown in the longitudinal section of the boiler.

The plate forming the top and sides of the firebox, is of 16-gauge copper, $9\frac{1}{4}$ in. long and $2\frac{3}{8}$ in. wide. Bend this to the arch shape shown, and rivet the end plates into it, with just enough $\frac{1}{16}$-in. copper rivets, to make it "stay put" while the brazing job is in process. I keep writing "brazing," but of course that applies to "bronze-welding" as well, with Sifbronze or any other similar material. If the edges of the flanged plates are ragged, smooth them off a bit with a file, before assembling the firebox; you never know when that old rapscallion Inspector Meticulous is coming for a tour of inspection around the depot. If he looks in the firebox and sees ragged edges, oh boy! You "won't 'arf cop out," as the kiddies would say.

The crown stays are made from 16-gauge copper, each needing a piece $1\frac{7}{8}$ in. × $2\frac{3}{8}$ in. Shorten one long side of each to 2 in. tapering out to the longer side as shown; then bend the flanges at top and bottom, as shown in the cross section of the boiler, and rivet each lower one (the longer) to the firebox crown, leaving about $\frac{5}{8}$ in. between.

The whole assembly can then be brazed at the joints. Stand it on end in the brazing pan, firehole ring



Details of bushes

upwards, and pile the coke all around. The whole lot should be well fluxed. Heat evenly till the coke glows, then concentrate on one corner until bright red. Apply the brazing material, and work slowly around, feeding in more of the brazing material as the flame slowly advances. It should "sweat" right through the width of the flange, and cover all the rivets. When you

(*Continued on page* 34)

Talking about Steam—

NO. 23. EXPANSION VALVE-GEARS

By W. J. HUGHES

As we have seen, there are various ways of obtaining variable expansion; some of these are manually controlled, and some are controlled by the governor. One of the type usually hand-controlled is that introduced by J. J. Meyer, of Mulhouse, in 1842, and used subsequently for thousands of stationary engines. In fact, there are many engines still at work which are equipped with this gear.

Meyer Valve-gear

In its essentials (see Fig. 4), this consists of a slide-valve working on an ordinary valve-face, with a pair of auxiliary valves sliding on the upper face of the main valve, something like the Wallis expansion gear described last time. As in that gear, the main-valve differs from an ordinary slide-valve, in which steam admission is controlled by the edges of the valve; it has two slots or ports by which steam is conducted to the valve-face. Cut-off is effected by the auxiliary valves closing these ports, of course.

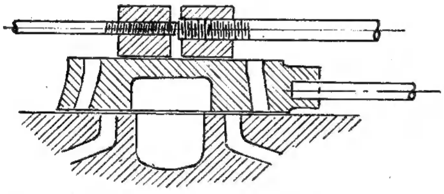


Fig. 4. Diagram of the Meyer valve-gear

However, where the *travel* of the auxiliary valves is varied in the Wallis gear to alter the cut-off, in the Meyer gear the travel is constant, and the *distance* between the valves or slides is variable. The slides are driven by separate eccentric, independently of the main-valve, of course. To effect the adjustment of the gear, the spindle has a left-hand screw for one slide, and a right-hand screw for the other, so that when the spindle is rotated, the slides approach or, alternatively, recede. The spindle is extended through a stuffing-box in the rear of the steam-chest, and Fig. 5 shows one method of fitting the adjusting handwheel so as to allow for the reciprocation of the spindle. The outer end of the latter is made of square section, passing through a squared hole in a bronze sleeve, which can rotate in a bearing bracket which may be bolted to the bed-plate or frame of the engine. A handwheel is secured to the sleeve, and as the wheel is rotated, so is the spindle, thus altering the distance between the Meyer slides and varying the cut-off.

As it is desirable to know what the cut-off is at any time, the inner end of the sleeve is threaded outside, and carries a nut to which a pointer is attached, indicating the cut-off position on a scale engraved on the outer casing, as shown.

Setting the Eccentrics

Fig. 6 shows how the eccentrics are set with this gear, *C* being the crank-pin, *M* the eccentric of the main valve, and *E* the position of the expansion eccentric. *M* is set to give the correct lap and lead, as in an ordinary slide-valve; that is, at 90 deg., plus the angle of advance, to the crank. *E* is set opposite to the crank, as a rule, but this position may vary slightly.

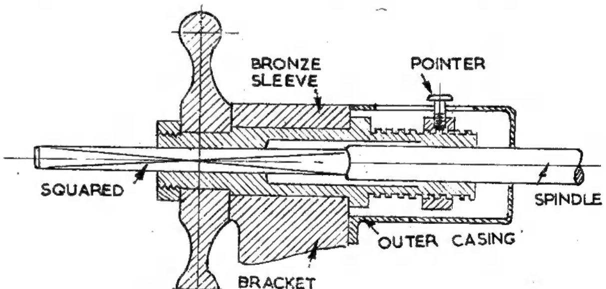


Fig. 5. Arrangement for altering cut-off in Meyer gear

Dimensions

A model horizontal engine incorporating this gear would be a very interesting and unusual one; I do not recollect ever seeing one, personally, whereas large numbers of full-sized engines, of varying powers, were built by many firms.

To anyone wishing to incorporate the gear in a model, the following dimensions may help in getting the right proportions, being taken from a prototype built in 1875. In fact, many of the dimensions may be of service to *anyone* wishing to build a mill-engine, with, or without expansion gear. The engine was fitted with a condenser and air-pump in tandem with the cylinder, and driven from an extension of the piston-rod. Bore and stroke of the cylinder were 27 in. and 36 in. respectively with a crankshaft 10½ in. diameter, and the flywheel 13 ft. diameter and 8½ in. face. At 60 lb. working pressure, the revolutions were from 70 to 75 per min.

Steam ports were 2⅛ in. by 18 in., with an exhaust port 3 in. wide. The main valve had ¾ in. lap and ⅛ in. inside lap, and was worked by an eccentric 18½ in. diameter by 2⅞ in. wide, keyed to the shaft. The cut-off eccentric was 20 in. in diameter by 2⅞ in. wide, and was fixed to the main eccentric by a single bolt, working in a slot to allow of fine adjustment.

Expansion-valve

The two slides of the expansion-valve were 5 in. wide by 20 in., and the travel was 6 in., the gear allowing a cut-off adjustable between ¼ and ⅝ of the stroke. Main-valve

Continued from page 646, *Vol.* 109, *November* 26, 1953.

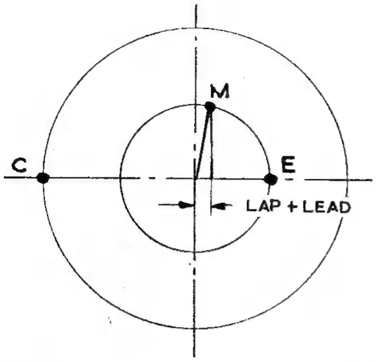


Fig. 6. *Eccentric setting for Meyer gear*

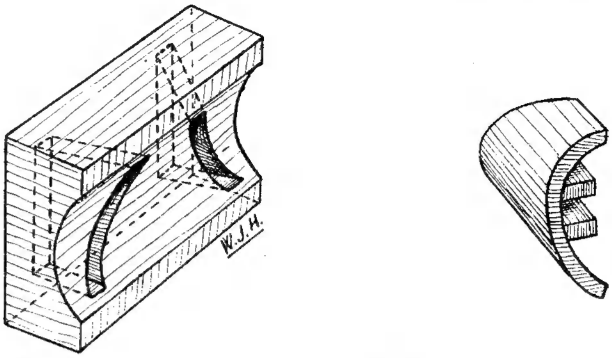


Fig. 7. *Sketch to illustrate principle of Rider expansion-valve*

spindle was 1¾ in. diameter, and cut-off spindle 1½ in. diameter, the two being 4¼ in. between centres. Square thread, left- and right-hand screws were cut on the latter, of ¼ in. pitch and 6 in. long. The right-hand thread was full diameter of the spindle, but the left-hand one was 1¼ in. diameter, to allow the front half-valve to be passed over it to reach the front screw. Similarly, the tail-end of the spindle, passing to the outside of the valve-chest, was reduced to 1 in. diameter to allow the rear half-valve to pass over it. The outermost 9½ in. of the spindle was made square section to take the sleeve of the handwheel.

Other dimensions of the engine include connecting-rod 7½ ft. between centres, crank-disc (overhung crank) 4 ft. 1 in. by 7¼ in. wide, crank-pin journal 6½ in. diameter by 8 in. long, main pedestal bearing 9½ in. diameter by 12 in. long, outer pedestal 8 in. diameter by 12 in. long. The bed of the engine was 20 ft. 5 in. long, with a separate piece bolted on for the condenser, 6 ft. 5 in. long, and was 15 in. deep, 3 ft. 10 in. wide at the top and 4 ft. 8 in. at base, narrowed to 10 in. wide (upper side) at the main pedestal and 1 ft. 11 in. for the condenser.

Later on, by the way, it may be possible to give drawings of this engine, but we had better not count our chickens !

Rider Valve-gear

In a previous article in this series (May 29, 1952), I described the Rider expansion valve-gear, as fitted to a Ruston, Proctor double-cylinder engine, and readers may remember that it was promised then to describe the gear in greater detail, at a future date. Since it will not take up much space, I am now reproducing again the sketch given in that article, and will briefly recapitulate the principles of working.

As in the Wallis and Meyer gears, the main valve has two ports to control the admission of steam to the cylinder, and the inner edges of these ports correspond to the outer edges of a normal slide-valve. But in this case, the ports or passages are twisted, so that on emerging at the concave outer face of the valve, they are inclined to one another, as sketched. The expansion valve is machined convex, to fit the concavity of the main valve, and has its outer edges cut at the same angles as the ports in it.

Driven by a separate eccentric, the expansion valve cuts off the steam at a suitable place; but, obviously, if it is rotated by some means, about its axis, e.g., in an upward direction, it will close the ports earlier and so give earlier cut-off. And vice-versa, of course.

We should mention, by the way, that in some designs the Rider valve was of the "closed" type; that is, the auxiliary valve was completely cylindrical, working in a cylinder bored through the main valve—something like a piston-valve, in fact—but the principle was the same.

In a modification of the Rider principle, often called the trapezium valve because of the shape of the auxiliary, the back of the main valve was flat (but still having the "twisted" ports), and the auxiliary, also flat and with inclined edges, was slid across it by means of a rack which meshed with a pinion on the expansion valve-rod.

Worked by the Governor

With Rider gear, this rotary movement of the cut-off valve is usually controlled by the governor (but occasionally by hand), and Figs. 8 and 9 show two of the ways in which the connection is made, allowing for both the reciprocating and the rotary movement of the rod.

Fig. 8 shows how the squared expansion valve-rod *E* passes through squared bushes in the double bearing bracket, in which the bushes can rotate. The arm *G*, connected to the governor, also has a square eye through which the rod passes. Thus, as *G* is rotated, so is the rod, and with it the Rider valve, altering the cut-off. At *A* in the same diagram is seen one method of connecting the eccentric-rod *R* to the valve-rod so as to allow the rotary movement of the latter. The bush is in two halves, tightened together by the nuts at either side of it, but the distance between the collars of the bush allows it to turn in the hole through pin *A*. Incidentally, the screw and lock-nuts allow of the necessary adjustments for correct valve-setting.

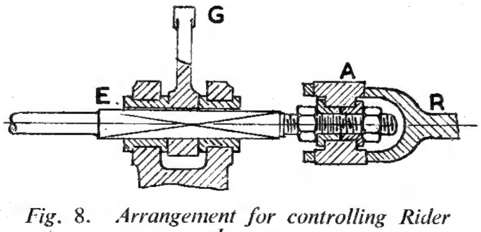


Fig. 8. *Arrangement for controlling Rider valve-gear*

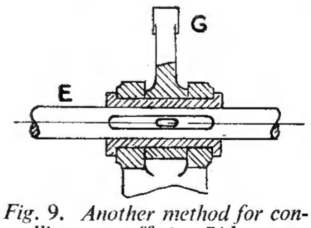


Fig. 9. *Another method for controlling cut-off in Rider gear*

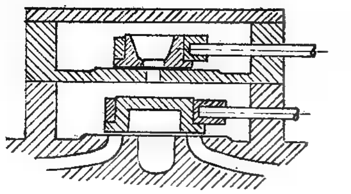


Fig. 10. *Separate valve used for giving fixed cut-off*

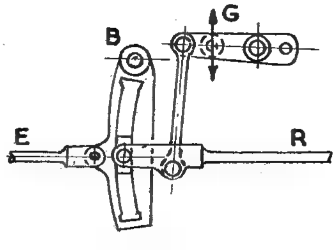


Fig. 11. *Arrangement for controlling Hartnell expansion-gear*

In Fig. 9, the expansion-valve rod is shown slotted, and a cotter is passed right through the link *G*, the bush, and the slot, from one side to the other. Consequently, the valve-rod can reciprocate, but it *must* rotate with the governor-link *G*. Again, of course, a universal joint must be allowed between the eccentric-rod and the valve-rod. In both diagrams, too, it should be understood that the brackets carrying the valve-rod bushes would be of the split variety, to allow the bushes to be placed in position.

A Double Slide-valve

Fig. 10 shows an arrangement for an expansion valve with a *fixed* cut-off, in which two steam-chests were used. It was frequently known as a " double " slide-valve, and, among others, was used by Davey, Paxman & Co. on some engines. (Don't confuse this with the *double-ported* slide-valve, by the way.) In this case, the main valve is of the normal D-type. Steam is admitted to the upper chamber, passing into the lower one through single ports cut in the centre of the expansion valve and the bottom of the upper chest, which forms the cover of the lower one. As before, the expansion-valve is worked by a second eccentric, which is set so as to cut off the steam at a predetermined point in the piston-stroke. The point of cut-off can only be varied by altering the position of the eccentric in this gear, of course.

Hartnell's Automatic Expansion Gear

A form of automatic expansion gear which was used widely on portable and semi-portable engines, as well as on stationary engines, was one designed by Wilson Hartnell. It was usually used to control a separate expansion-valve, and is shown diagrammatically in Fig. 11. This sketch does not show the governor, which will be dealt with later on in this series along with other types of governor. The eccentric-rod *E*, driven by a separate eccentric, vibrates the curved link, which is suspended from a pivot at the point *B*. The radius-rod *R* drives the expansion-valve, and is attached to a die-block which can slide up and down in the slot in the link. The arm *G*, pivoted at *A*, is controlled by the governor, and being thus linked to the radius rod, the governor controls the position of the die-block in its slot.

With a normal load, the gear is arranged so that *E* and *R* are in line as shown, so that there is little or no " die-slip," but with a heavier load, tending to decrease the speed of the engine, *G* will drop. This gives a longer travel to the expansion-valve, and so delays the cut-off. Similarly, under a lighter load, the travel of the expansion-valve is reduced, giving greater expansion.

L.B.S.C.'s TITFIELD THUNDERBOLT

(*Continued from page* 31)

arrive at the firehole ring, play the flame directly on it, and when the whole ring glows bright red, run a fillet completely around. If the job is hot enough, the fillet will be perfectly even. I usually " continue the course " until I reach the bottom again; but anybody who prefers, can make a fresh start at the bottom, and work up to the top again, taking care to see that the metal flows properly when the junction is reached.

Next, turn the firebox the other way up, and ditto repeato the operation, right around the joint between flange and sheet. Plenty of heat is a good thing; but always remember that you can have too much of a good thing, and if you suddenly find one big ragged hole instead of eight nice small round holes, it's going to be just too bad. Therefore, keep the flame as much as possible, off the metal between the tube holes.

Finally, stand the firebox in the coke, right way up, and give the flanges of the crown stays a dose of brazing material; don't forget to cover all the rivet heads. Inexperienced coppersmiths can, if they so desire, lay a strip of coarse-grade silver-solder alongside each flange, and apply the flame until they melt and sweat through; a tip I have given " many a time and oft." When the job has cooled to black, it can be put in the pickle again for 15 minutes or so, and then thoroughly washed off in running water, cleaning up as before. I always clean every brazing or bronze-welding job, as I go along, as I just hate to handle dirty copper. As new hands at the locomotive-building craft, often ask if they can use silver-solder throughout, as it doesn't require so much heat as brazing strip, the answer is yes, *provided that they use a coarse grade for the jobs specified above.* If a very easy-melting material is used for the whole lot, it will be found—as many have already found, to their dismay—that on the final spasm, some of the earlier joints will crack; and as fast as one place is put right, another will split.

Next stage, fitting tubes and assembling the boiler.

★ *Our Cover Pictures*

Readers of *THE MODEL ENGINEER* are invited to submit for consideration photographs which may be suitable for cover pictures. The subject must be within the scope of this journal and reference to the covers of this year's issues of the " M.E." will give an indication of the type of photograph preferred. If accepted for publication, a reproduction fee of two guineas will be paid.

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AN EXPERIMENTAL COMBUSTION APPARATUS

By G. Marden

THE work described below was carried out as a preliminary investigation into the design of a solid fuel flash steam generator.

Previous experience with a blow-lamp-fired flash steam plant had shown that, in the early stages of development, it may prove very difficult to operate the units under constant conditions for a sufficient length of time to enable the functioning of the individual components to be studied. It was decided, therefore, to build a simple water-cooled furnace, prior to finalising the design of the flash generator. This enabled experiments to be carried out with a pressurised furnace, as opposed to the more usual induced-draught system. It also yielded data concerning the evaporation which might be expected from a given area of heating surface, the relative evaporations from the furnace and the convection heating surfaces, and the weight of coal which could be burnt per unit of grate area per hour, without excessive chimney losses. The ability of the fire to remain banked during standby periods was studied, and some of the conditions were ascertained which would permit the coal to continue to burn very slowly.

Apparatus

The test rig is shown diagrammatically in Fig. 1. It was constructed from sheet iron, varying in thickness from 22-gauge for the furnace walls, to $\frac{1}{8}$ in. for the tube plates, and all the joints were either welded or brazed. The furnace water system is entirely separate from that of the tubular heater, and both evaporators were fed with water by gravity via screw-down regulating valves. A system of baffles was used to prevent loss of water due to priming, as violent ebullition is liable to take place when evaporating at atmospheric pressure.

The heating surface of the combustion chamber, including that of the roof tubes, is 1.66 sq. ft. and that of the tubular convection heater is 1.86 sq. ft.

Air is supplied to the fire by an impeller fan, 4 in. in diameter, and belt-driven at about 4,500 r.p.m. by an electric motor. The air flow is controlled by a throttle on the intake side of the fan. Hand firing could not be employed because the pressure inside the firebox reached a value of about 1 in. of water in excess of the atmospheric and blowback would have occurred as soon as the firing door was opened. This difficulty was overcome by using a hand-operated ram to deliver coal to the fire. The ram was situated at the base of a hopper-shaped bunker, having a large air-tight lid. Under working conditions, the pressure within the bunker is equal to that existing in the furnace.

Test Method

The fire was lit by inserting into the firebox a rag, which had been soaked in paraffin. After the rag was well alight, wood and coal were fed by hand and then the electric blower was started. This method is very dirty, and generally unsatisfactory. The need is felt for something less tedious and more reliable, such as an inflammable cartridge which, when placed on the grate and lit, would ignite the coal charge directly. So far, it has not been possible to develop such a method of initiating the fire.

However, once the fire became incandescent, the water levels in the two evaporators were brought to fixed marks and measured quantities of water were introduced into the separate feed tanks. The air throttle was adjusted to give the required draught, and the level of the fire above the grate was observed. The conditions were maintained as uniformly as possible throughout the test period, which was never less than one hour in duration. All the results described

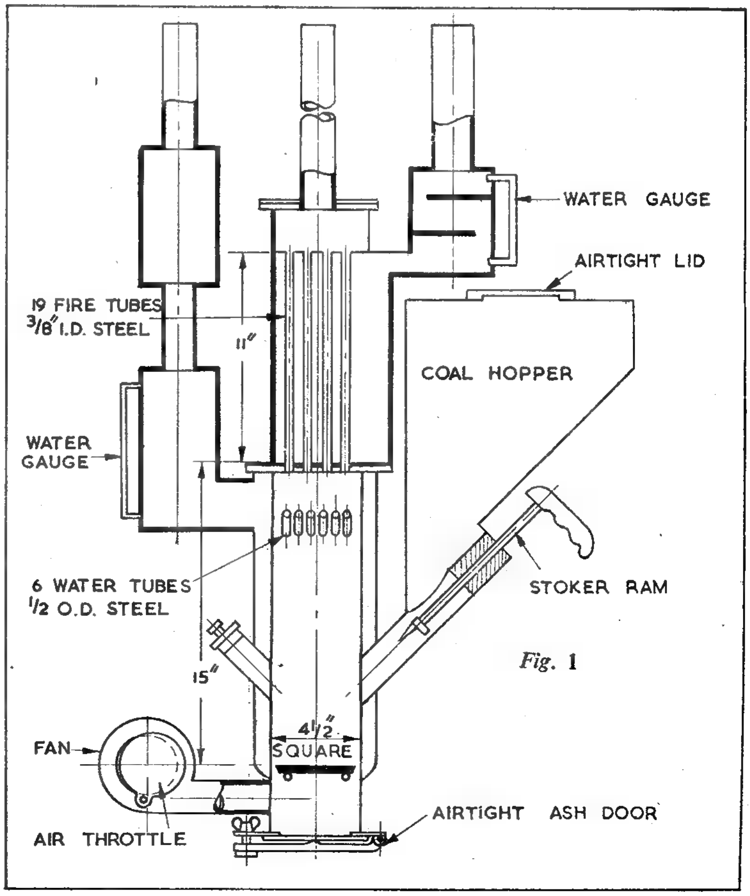


Fig. 1

below were obtained with bituminous coal. The widely advertised " Nutty Slack " proved to be quite satisfactory but was inclined to cake into a solid lump, which had to be raked at intervals of about 20 minutes. At full output it was necessary to operate the coal feeding ram every two minutes.

Since no means were provided for determining the weights of coal on the grate at the commencement and at the conclusion of a test and, because of some difficulty in completely emptying the coal bunker, accurate fuel consumption measurements were not obtained. Nevertheless, attempts were made to achieve reasonable estimates of the weights of fuel supplied to the fire.

Evaporation Results

The combined evaporation (212 deg. F.) of the combustion chamber and tubes reached a maximum value of 37.7 lb./hr. The former accounted for 28.8 lb. and the latter boiled the remaining 8.9 lb. At this output, approximately 6 lb. of water were evaporated per lb. of coal. This figure is lower than that which would be expected in full-size practice, and this may be partly due to the large unlagged outer surface areas of the two evaporators.

The greatest weight of fuel consumed per sq. ft. of grate area per hour was approximately 47 lb. This is in good agreement with the maximum combustion rates recorded in steam wagon vertical boilers, but is very much lower than the corresponding figure for locomotives.

Fig. 2 shows the relative evaporation, per sq. ft. of heating surface, of the firebox and the firetubes over a range of boiler output. The small contribution made by the firetubes under light load conditions is significant.

When the tubular evaporator was removed, the maximum evaporation from the combustion chamber alone, at 212 deg. F., was 31.4 lb./hr. In this case the weight of water evaporated per lb. of coal was only about 4.8 lb. The rate of combustion was approximately 49 lb. per sq. ft. of grate area per hour and the chimney became red-hot for the first 12 in. of its length.

To assess the effect on steaming of clinker formation in a furnace of this type, a test was carried out with " Nutty Slack " fuel, using the lower combustion chamber only. The firetube section of the heating surface was omitted because of a tendency for soot blockages to occur after several hours' steaming.

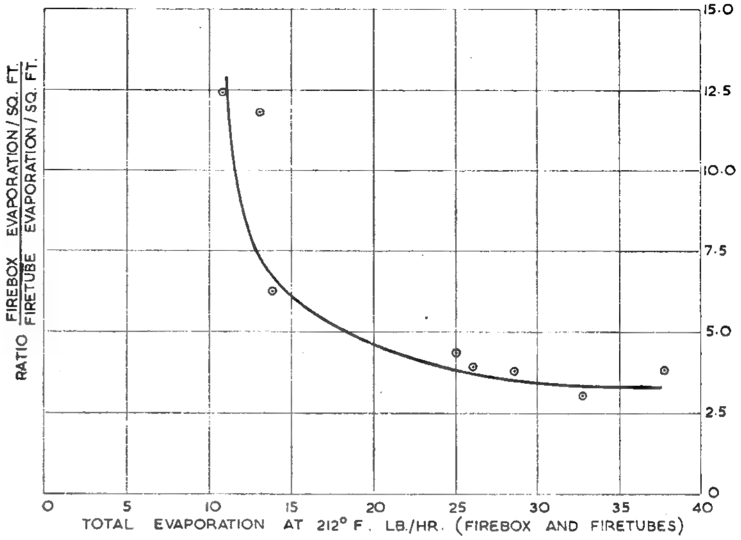


Fig. 2

This, of course, would have introduced an additional factor into the test. The draught control was maintained at a constant setting and the fire thickness was kept at approximately 2 in. The mean hourly evaporation, at 212 deg. F., was 23.8 lb. in the first hour, 23.4 lb. during the second hour and 22.6 lb. in the third hour. Thus the steam output during the third hour was 5 per cent. less than in the first.

Banked Fire Tests

In order to provide sufficient draught to maintain the fire during standby periods, it was found that a chimney height of 4 ft. above the grate was required. The internal diameter was $1\frac{7}{8}$ in. It was not necessary to restrict the entry of air into the ashpit with this length of chimney.

If a charge of fresh coal was added to a good red fire, it could be left unattended for four hours and, almost without exception, could be relied upon to reach a fierce intensity within 30 seconds of switching on the blower. On several occasions the fire was revived after a banked interval of eight hours, and once or twice it survived even longer. The evaporation during the standby period was negligible, and it was possible to insert a finger into the furnace door without experiencing any discomfort. It seems probable, therefore, that the coils of a flash boiler would suffer no damage under these conditions, even if they were to become dry.

The problem of maintaining the fire whilst the boiler is shut down is not considered to be completely solved, as yet. However, if a more satisfactory method of lighting up could be devised, the need would seldom arise for banking the fire for more than four hours.

Application of Test Results

Data obtained from work with the combustion chamber has been incorporated into the design of a flash boiler. Although well advanced, this has not yet reached the testing stage.

There would appear to be an unfortunate lack of published test results in the realm of model engineering. Although research work is undoubtedly being carried out in various parts of the country,* actual values of b.h.p., specific fuel consumption and other relevant facts appertaining to model steam and i.c. engines are very difficult to find. Swinging field electrical dynamometers may be easily constructed from car or motor cycle dynamos and have been used successfully for commercial research on small power units. The task of the amateur model designer would be facilitated and much overlapping of the research work carried out by individuals would be avoided, if the results of actual tests were to be published more frequently.

* The S.M.E.E. Locomotive Testing Plant, " M.E.," April 17th, 1952 and Testing Small Locomotives, Charles R. Wilkinson, " M.E.," January 15th, 1953.

Making the Most of your "M.E.s"

By W. H. Rider

WE, who treasure our copies of THE MODEL ENGINEER as a mine of information, to the extent of having them bound into volumes, find that, as time passes and the number of volumes grows, the philosopher who said: "Nothing in this world has advantages without drawbacks," was right, the drawback in this case being the difficulty of locating a particular article without many hours spent in a protracted search.

Our "mine of information" then takes on many of the attributes of a junk heap, to wit, a lot of useful material in a disorderly state. True, each volume carries a comprehensive index unless one was unlucky enough to miss some of the loose ones during the paper shortage, but this means wading through the volume indexes in turn to unearth our objective, unless the memory retains a vague idea of the approximate time when the article was published; furthermore the particular item of information one is seeking may very well be buried in an article with a title bearing no relation to it.

Pondering on this problem while watching the number of volumes grow, the writer realised that if they were to be really useful in proportion to the amount of information contained, "something would have to be done about it." It was felt that some kind of book in the nature of an "Encyclopaedia Model Engineerica" would fill the bill, but would be rather a monumental task for one who already has difficulty in fitting in all the jobs to be done (whilst still leaving some leisure to be spent in the workshop) bearing in mind the number of cross-references which would be necessary to make it a simple matter to turn up any reference readily.

It was, therefore, decided to try the effect of a classified index restricted to topics of particular interest to the writer. It was realised that the index would have to be of the loose-leaf variety so that it would be like a famous book-case, "always complete but never finished." This scheme has worked very well and the writer thought that maybe others might be interested.

A start was made by looking through the back volumes, one at a time, and jotting down those items which seemed likely to be required for future reference. This was done on sheets of foolscap, the classification being carried out subsequently. It could have been done straight away but it was found more comfortable to work in this manner in an armchair by the fire during winter evenings, when the temperature in the workshop reduced one's enthusiasm to a very low pitch.

The classification, of course, will depend upon individual taste. The writer's particular interests are scheduled thus:—

(1) Workshop Appliances and Processes.
(2) Traction Engines
(3) Power Boats.
(4) Refrigerators.
(5) Stationary Engines and Turbines, etc., etc.

One page was taken for each subject and entries were made thus:—

Dividing Attachment (4 in. Lathe)—J. Smith—428/78.

Toolpost, Rigid Height-adjusting—T. Brown—123/92.

The author's name was included as this often recalled something of the article in question to mind and also gave an important clue to the quality of the details and instructions, e.g., J. Latta, "Duplex," E. T. Westbury and "L.B.S.C." are as good as a hall-mark where originality, ingenuity and lucidity are concerned. The first figure indicates the page and the second the number of the volume. An asterisk is added as a mark of special approval to certain items when it was thought that a tool or model might be made at some future date. Similarly, the letter (L) was added to indicate a letter in the correspondence columns and other references may be added to suit the needs of the compiler.

This system worked very satisfactorily for some time, in fact, until the "Workshop Appliances and Processes" section ran into several pages, when the loose-leaf system showed its worth.

The pages devoted to this heading were removed and split up as follows:—

1(*a*) Lathe Design (a subject in which the writer is intensely interested).
1(*b*) Dividing Attachments.
1(*e*) Toolpost Attachments.
1(*d*) Tailstock Attachments.
1(*e*) Multi-purpose Machine Tools.
1(*f*) Millers, Drills, Shapers, etc.
1(*g*) Hand and Bench Tools.
1(*h*) Workshop Recipes.

It is often advantageous to cross reference under two or more headings, e.g., an article on Lathe Design might include attachments which would make it desirable to include it under Multi-Purpose Tools and occasionally two or more fittings are included in one article. This again can be carried to any degree according to personal taste.

A few special cases have been made. Our worthy and prolific friend "L.B.S.C." has his own special section in the system. Under this are grouped the locomotive serials giving the name, type and gauge of the engine and the page on which the serial commences. Other items are Lobby Chats and the subjects dealt with, and special machining set-ups (or should it be sets-up) and workshop wrinkles known collectively as "'ints and tipses."

"Duplex" and E.T. Westbury are similarly treated.

Now, when I require a dividing attachment, milling attachment or some other "means to an end," I can rapidly refer to all the accessories of a similar nature which have been described or illustrated in the last fifteen years or so, abstract what appears to me to be the best features of each, modified if necessary to suit my own requirements and re-hash the design with refinements to taste, knowing that the result will be a practicable proposition from every point of view. This sounds very long-winded but actually takes less time and gives more satisfaction than dashing off a quick effort and subsequently finding that it is deficient in some desirable detail, or coming across an article by chance, published years ago which is the "very identical."

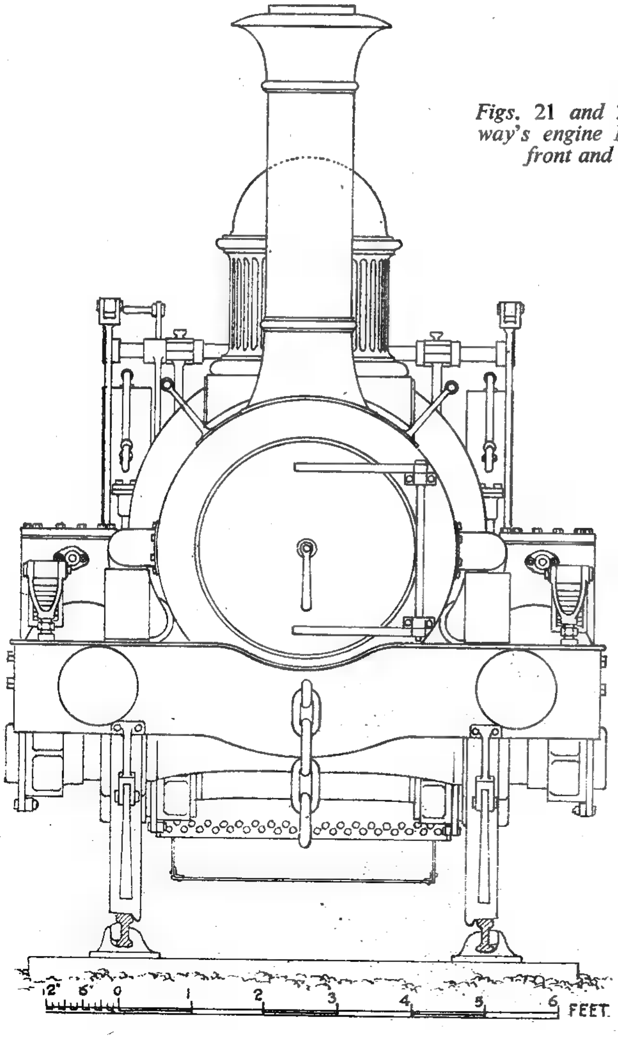
This concludes the outline of my "Key to the Model Engineer." It will not suit everybody (that is why we haven't an ideal lathe), but that is so much the better since it permits that individualistic touch without which the true model engineer would not be the fellow he is, and if these brief notes enable a few of the fraternity to obtain more benefit with less trouble, from their accumulated back numbers, I shall feel that my time has not been wasted.

BRITISH CRAMPTON LOCOMOTIVES

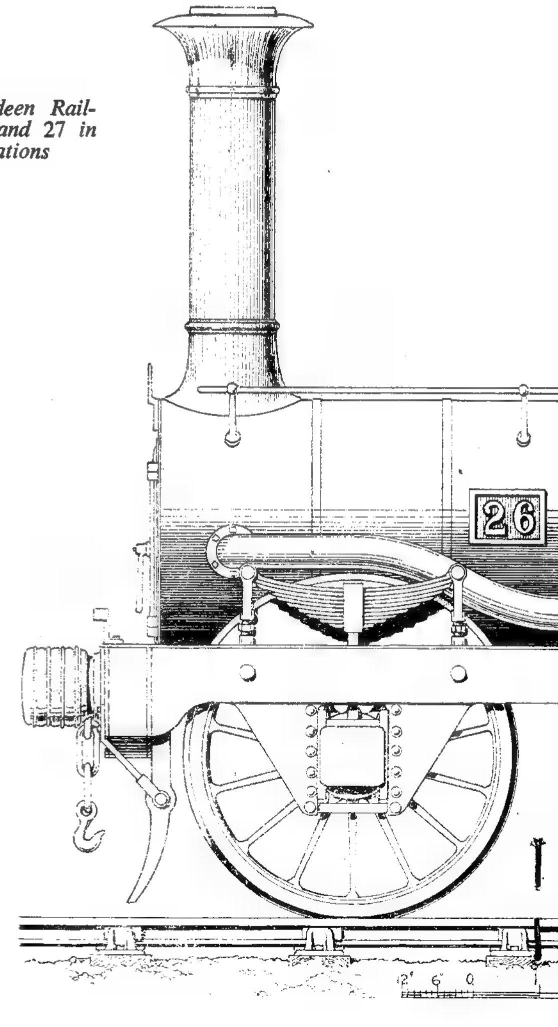
By E. W. TWINING

PART 9

In the year 1850, there were delivered to ■ Scottish Company, The Aberdeen Railway, who had purchased them ready finished, two Crampton engines built by E. B. Wilson & Co., of Leeds. Mr. Jas. F. McEwan, in his "History of the Locomotives of the Caledonian Railway" (*The Locomotive*, September, 1943) tells us that the precise date of building of these two engines is unknown, but is believed to have been at least a year previously and "were part of an order given to Crampton by a Continental line and subsequently cancelled." The year of construction would therefore be 1849 and they must have followed on, in Wilson's shops, immediately after the six engines for the North British and the Eastern Counties



Figs. 21 and 22 Aberdeen Railway's engine Nos. 26 and 27 in front and side elevations



Railways, which engines have already been dealt with.

Drawings

No authentic drawings appear to be in existence showing their original form and details but it seems highly probable, and would follow almost as a matter of course, that they were built from the same drawings as the immediately preceding N.B.R. No. 55 and E.C.R. 108-112; they would, therefore, have the same appearance as their predecessors with the exception of the form and arrangement of the regulator. Instead of the square box and the push-and-pull regulator-rod, which is shown in Fig 17, Messrs. Wilson fitted on these boilers their beautiful fluted dome casing, which is such a characteristic feature of all their designs. This dome contained the regulator, probably of the vertically sliding type, and a rod, inside of the boiler, operated by the usual form of handle, having side-to-side movement, in a quadrant.

These two engines, in this, their original form, were numbered by the Aberdeen Company: 26 and 27 and are illustrated in the accompanying drawings: Figs 21 and 22.

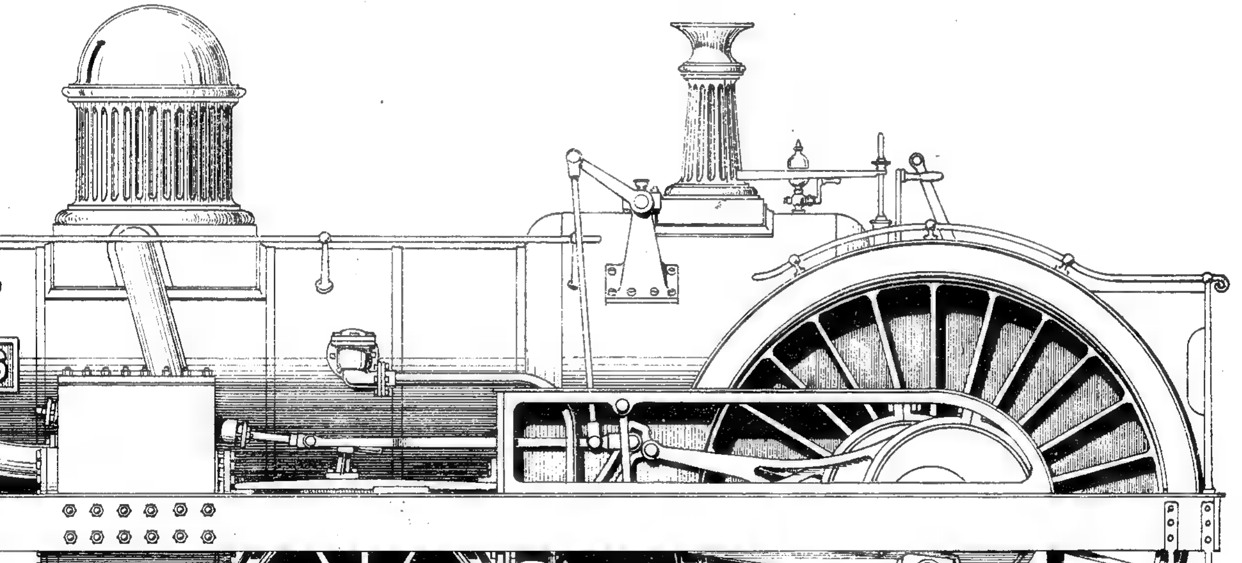
Valve-gear Alteration

It will be seen that Crampton's patent large eccentrics were fitted with Gooch gear. Apparently, these gave trouble for Mr. McEwan says that E. B. Wilson later supplied smaller eccentric sheaves and straps. Such a change in the size of the eccentrics must have involved a complete alteration in the valve-gear and crank arrangement for the new small eccentrics would have to be carried on return cranks placed outside of the connecting-rods. Possibly, Stephenson link motion was substituted and made similar to the earlier Cramptons by Tulk and Ley and thus became as shown in Mr. L. Ward's beautiful drawing which illustrates Mr. McEwan's article. In this drawing no number plates are shown and it is to be assumed that the engines are represented as they were after the formation of the pool between the Aberdeen Railway and the Scottish Midland Junction Railway, in which pool the engines were renumbered: 73 and 74. Then, in 1856, the two companies were absorbed in the Scottish North Eastern Rly. and in 1859 the engines were again renumbered: 2 and 3. In 1860-61 they were entirely rebuilt as 2-2-2 type engines, when Gooch fixed-link motion was again fitted. When they became the property of the Caledonian Railway Co., in 1866, they were no longer Cramptons and we are not, here, further concerned with them.

Dimensions

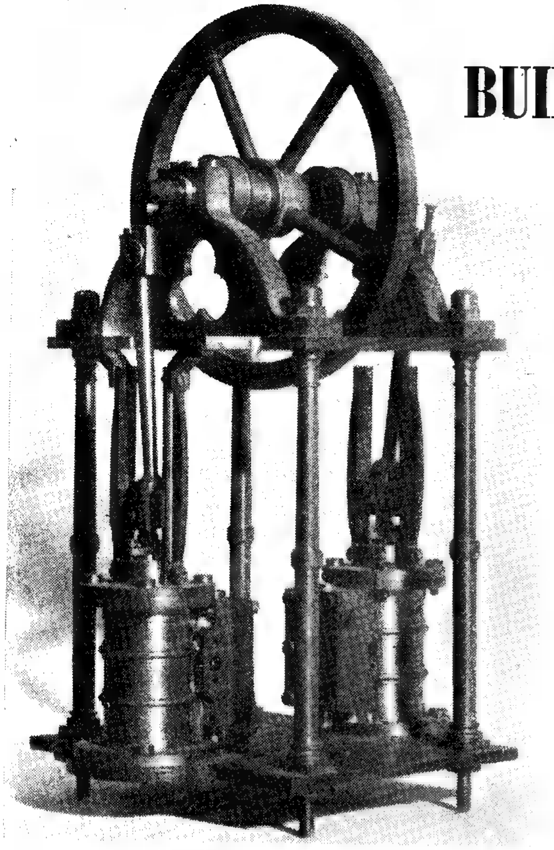
As originally built by Wilsons, the wheel diameters were: leading, 4 ft. 6 in; intermediate, 3 ft. 9 in.; driving, 7 ft.; wheelbase, leading to intermediate, 7 ft. 6 in.; intermediate to driving, 7 ft. 9 in. Total 15 ft. 3 in.

(*Continued on page* 50)



BUILDING UP FLYWHEELS

By Andrew Todd



THE following method of making built up wheels may interest readers, as I have made a number of them for simple models and toys. They run true, the rim is heavy compared with the rest of the wheel, and while they are not as strong as a solid wheel, they are sound enough for most model work. I have run a 4 in. diameter wheel at 6,000 r.p.m. without it coming adrift.

The first photograph shows a finished wheel fitted to a twin-cylinder vertical steam engine which I am building. The engine is made in brass, and when finished, will be polished all over and lacquered. It is being made as a mantelpiece ornament, and is based on one of the late Mr. Muncaster's designs in THE MODEL ENGINEER for 1909.

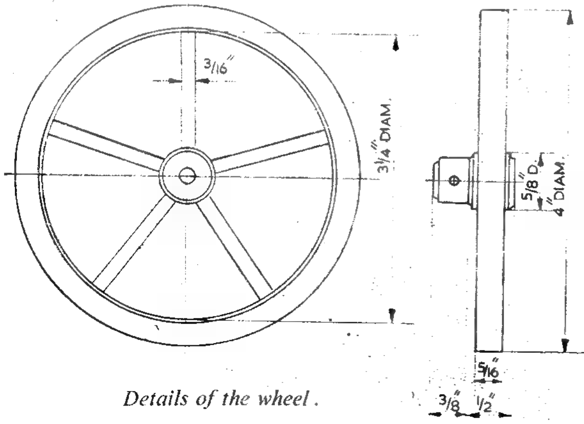
The rim of the wheel is made first, and I looked for an old bush to part a slice off it. The bush is caught in the chuck, and skimmed out in the bore, the end faced, and outside diameter turned to size. The rim is then partly parted off, and marked out for spokes. I use the bull wheel on my lathe for dividing, and to mark the centre of holes I use a centre-punch, sliding in a block of steel. In my case, this was a piece of 1 in. × ½ in. B.M.S. 2 in. long set up square on top-rest, centre-drilled from headstock, and drilled and reamed ¼ in. bore. This guarantees that the hole is located accurately on centre height, which fact is useful on many jobs.

The punch is a piece of silver-steel, with an accurate point turned on it; a 60 deg. angle is better than a 90 deg. one. A light tap will give a mark sufficiently large to start a drill.

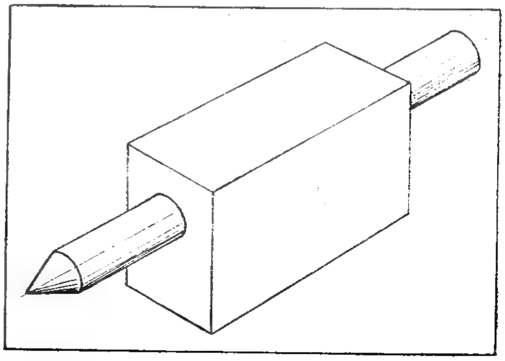
If doubts are felt about flatness of parting cut, keep line of holes nearer the faced end of rim to allow of a good facing cut being taken on parted face.

I have a No. 1 Champion drill which I can set up on lathe, and I use this to drill the rims before parting off. If this, or a drilling spindle, is not available, part off the ring and drill it in the lathe or a drill press. It is important that the holes are drilled radially and parallel with the edges. Clamp the rim to an angle-plate, with one of the pop marks on top, press the blade of a square against the rim and measure distance from blade to pop. Do the same from the other side, and when distances are equal, start drilling with a centre drill and then drill right through rim with a No. drill. Do the same for all other spokes, and remove burrs from inside rim. If rim is drilled in the lathe, pack it up on saddle to centre-height, and square up pop off faceplate and aligning pop with centre of lathe at same time.

The spokes are made next, and should be of such a length that when screwed into boss the diameter over



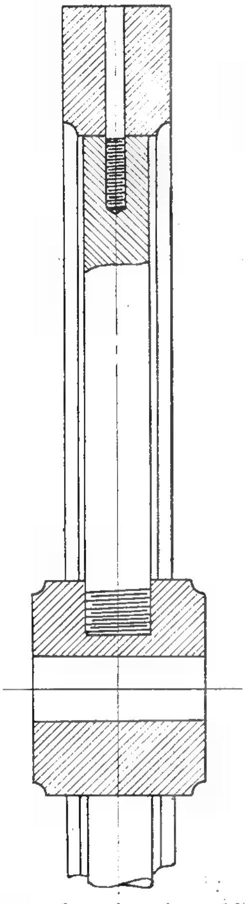
Details of the wheel.



Toolpost centre punch

spoke ends is about $\frac{1}{16}$ in. larger than the bore of rim, be careful to make the screwed portion the same length on each spoke, and note that when spoke is screwed home into boss, this thread should not show; the end of thread should be covered by counterbore in boss. The other end of spokes should be accurately centred, drilled and tapped 6 B.A.

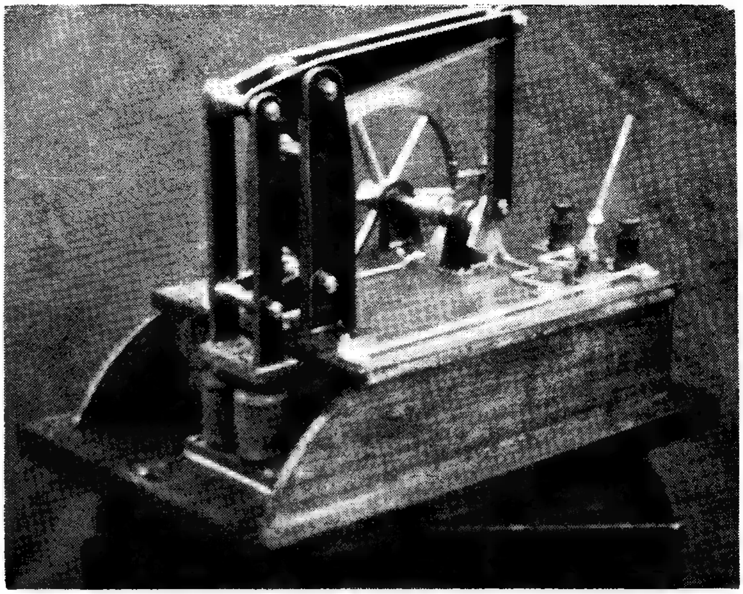
Short lengths of brass wire, a push fit in holes on rim are screwed to fit spokes.



Section through spoke and boss

The boss is made next, from a piece of brass bar caught in chuck, profiled, faced, centre-drilled, bored and reamed to fit shaft. It is completed except for parting off. The centre of spokes are marked off and drilled and tapped, using the same methods to align holes as were used in rims; do not remove boss from chuck at any time.

To drill the holes, I use a centre-drill to open out pop, then open out with a drill the diameter of spoke for a depth of $\frac{1}{16}$ in. Then the tapping size drill is used. The hole is bottomed with a flat-ended drill and finally it is tapped to fit spokes. Tap the hole in machine, not by hand, to ensure that the spokes will be truly radial, after which they can be screwed in tightly. The ends of spokes are now turned until rim can be tapped over them. using a high speed, a keen tool and very light cuts for this operation.



Before fitting rim, slightly countersink 6-B.A. holes on end of spokes and clean out with tap. Press rim over spokes and screw in short lengths of brass wire tightly. Cut off surplus as close to rim as possible and lightly skim top of rim. If care has been taken in drilling, the rim should be true, but if not, lightly skim edges, using a high speed and very light cuts to avoid chatter. If rim has to have a high polish, do it now and part off boss. Mount wheel on a short mandrel and skim off end of boss, and remove burr from bore.

The second photograph is of an electric beam engine with a 4 in. diameter flywheel made by above methods. This engine was made as a Christmas present for a boy about 11 years ago from a design which appeared in THE MODEL ENGINEER about 1904, and was also featured in one of the "M.E." handbooks. The dimensions are approximately as in original design, but beam, columns and connecting-rods are made in thin brass plate flanged over 3/32 in. thick formers, instead of a wooden beam and supports.

SURFACE TREATMENT OF METALS

In the article on the above subject, by Mr. C. G. Green, in our issue of November 5th last, reference is made, under the heading "Phosphating Baths," to "Parker bonderising," implying that there is only one solution to which this term applies. We have, however, been advised by the Pyrene Co. Ltd., Metal Finishing Division, Great West Road, Brentford, Middlesex, that the terms "Bonderising" and "Parkerising" (incorrectly spelt in the above article), are in fact their registered trade marks, and should always be used with a capital initial letter.

They further inform us that their range of metal finishing processes include, in addition to those named, "Spra-Bonderizing" and "Parco-Lubrizing," in which there are twenty-two distinct phosphate processes, all widely used throughout industry for various purposes such as bonding paint and adhesives, resisting corrosion, and assisting the cold working of metals.

We need hardly add that the errors and omissions in our article were quite unintentional, both on our part and that of our contributor, and we are glad to have an opportunity of correcting any misunderstanding, and amplifying the information contained in what was otherwise a very useful practical article.

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering [redacted] replied to by post [redacted] promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of [redacted] practical nature on subjects within the scope of this journal.
(2) Only queries which admit of [redacted] reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover [redacted] any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such [redacted] examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Mounting [redacted] Cylinder Block

I am building a 1½-in. scale model Burrell traction engine. Would you kindly inform me if it is necessary to put [redacted] strengthening-piece inside the boiler where the cylinder-block goes? The boiler is made of 16-g. drawn copper tube and the cylinder is to be secured by thirty 3/32-in. hexagon-head brass screws.

T.A.J. (Truro).

We suggest that a pad of at least the [redacted] thickness [redacted] the tube of the boiler barrel should be placed under the cylinder block, and outside the barrel. You will find this a much easier job than trying to fit a strengthening-piece inside the barrel.

Hot Pressed Castings

Could you tell [redacted] the meaning of the term "hot pressed"? Does it signify any particular alloy?

E.R.J. (Swansea).

The term "hot pressed" is applied to certain small brass castings which are produced in [redacted] mould, under pressure, while the metal is in [redacted] plastic state. So far [redacted] we are aware, no special alloy is necessary for this process.

4-mm. to ¾-in. Scale

I want to build a 3½-in. gauge ¾-in. scale model of [redacted] Adams T6 class 4-4-0 L.S.W.R. engine, and have been unable to obtain [redacted] good external drawing in this scale. A friend showed me [redacted] copy of The Model Railway News *for April,* 1952, *which contained [redacted] first-class drawing to* 4-mm. *scale, but this, of course, is useless for my purpose. Could a ¾-in. scale enlargement be made from this reproduction. If so, it would be exactly what I want, as I intend to make my model [redacted] near as possible to scale externally.*

M.H. (Exmouth).

It [redacted] quite possible to have a photostat copy made from the "M.R.N." reproduction, and to any desired scale; but there is really no necessity to go to that trouble and expense, since, in spite of your remark that the 4-mm. scale reproduction is useless to you, we suggest that you can quite easily make use of it. If you study it again, you will see that there is [redacted] scale of prototype feet and inches reproduced under the drawing, and all that you have to do is to take any required measurements from the drawing by means of dividers, transfer them to the printed scale below the drawing, and read their dimensions in scale feet and inches. The same number of feet and inches in ¾-in. scale will be required for your model. We can supply you with a copy of the "M.R.N." for April, 1952, if you require it; price 1s. from our Sales Department.

"Twin Sisters" Cylinders

Will you please let me know the bore and stroke of Mr. Austen-Walton's "Twin Sister" locomotives? Also, in which issue of THE MODEL ENGINEER *these dimensions were given?*

B.K. (Oxshott).

This is the first time we have been asked for this information, so we presume that it must have been given at one stage in the series. We have been unable to discover any definite statement of the sizes required, but the wheel drawing published on June 9th, 1949, suggests that the piston stroke is 1⅞ in. The piston drawing, published Sept. 14th, 1950, also shows that the cylinder bore must be 1⅜ in. diameter.

Steaming Difficulty on [redacted] Traction Engine

I have completed a traction engine with spirit-fired, water-tube boiler, hand feed pump and steam-drying loop through the fire. The steam generation is sufficient to run the engine out of gear, but the engine gradually loses pressure when running. I want to make a paraffin, petrol or spirit blowlamp to get under this firebox; can you tell me where I can get the necessary information. The sketch (not reproduced) shows the arrangement.

C.R. (Godalming).

We regret we cannot advise you as to where you can obtain the information you require. On looking at your sketch, however, we feel that your present spirit lamp is not the cause of your boiler failing to steam. We are sure that the trouble is caused by the circulating drum that is shown fitted at the back of the firebox; it takes up a lot of room, which means that you cannot provide enough wicks for the lamp. We suggest that you remove this drum and replace it, if necessary, by simple bent water-tubes.

This will enable you to provide two more wicks on your existing lamp and allow of a much improved draught through the firebox, both of which should lead to better steaming of your boiler.

Miniature Transfers

In view of the impossibility of obtaining from the trade transfers for numbers, lettering and crests for 3½-in. gauge locomotives, would you please let me know how to set about making them for myself? The numbers I have made a tolerable job of painting on direct, so it is the crest I am most concerned about.

M.D.M. (Swansea).

We do not think that we have ever published [redacted] description of any method of making miniature transfers. The process is extremely complicated, costly and well outside the scope of this journal. The best solution of your problem is by hand-painting the crests.

Simple Locomotive Models

I am sure that THE MODEL ENGINEER *has, from time to time, printed [redacted] "how to do it" article for young and/or inexperienced readers. I have always wanted to build a locomotive but have never found opportunity to devote myself to the art of the workshop. Now, well established as a family man, I am at last attending evening classes in metal work. Could you please give some guidance to [redacted] newcomers to the craft? I think an externally-fired "O" or "1" gauge 0-4-0 would be enough to tackle as a first job. It would have to be [redacted] "simplified simplified" "Tich"!*

G.O. (Chislehurst).

It is difficult for us to make a decision in your case, because nearly all "L.B.S.C." engines [redacted]

ntended for people who have not much knowledge or experience in the use of workshop equipment. *Tich*, as described by "L.B.S.C." is just about the simplest possible design that could be imagined for a coal-burner, and there could scarcely be a simpler engine in any size. However, if you definitely favour an externally-fired "O" or "1" gauge engine, we would suggest *Mollyette* for "O" gauge, our drawing No. L.O.51, or *Juliet* for "1" gauge, our drawing No. L.O.53. Several of our regular advertisers supply castings for both these engines.

Acme Threads

I have recently purchased a second-hand milling machine, and I intend to renew the feedscrews and nuts, as these are in bad condition. The original screws are what I believe to be of Acme form; that is, having sloping sides.

It seems to me that this form of thread would be much more difficult to cut and fit correctly than would be the ordinary square thread which I have seen on similar feedscrews. Would you please advise whether the square form would be satisfactory in this instance, and, if not, what are the peculiar advantages of the Acme thread?

B.B. (Warrington).

The Acme thread, having an angle of 29 degrees between the sides, possesses certain advantages of strength, particularly in resistance to shearing stress. Its form also lends itself well to the engagement and disengagement of clasp-nuts, such as are found on the usual lathe carriage.

As the shear stress on machine feedscrews and nuts is rarely high enough to strip out the threads bodily, its popularity on commercial machinery is mainly due to the fact that the Acme form is much easier to cut with taps and dies, due to the much greater strength in the teeth of both taps and dies, and the better facilities for freeing the chips.

Mechanically speaking, there is no more difficulty in screwcutting the Acme form than there is with the square form, except that greater care must be taken to ensure that the angles and the sizes of the internal and external screwing tools are identical. If the angles of the screws and nuts differ, even to a quite small extent, an unsatisfactory and quick-wearing job must ensue. Most amateurs, therefore, may obtain better results with the square thread, except in those cases where a clasp-nut must be employed.

For the BOOKSHELF

Railway Adventure, by L. T. C. Rolt. (London: Constable & Co. Ltd.). 176 pages, 5½ in. by 8½ in. Illustrated. Price 21s.

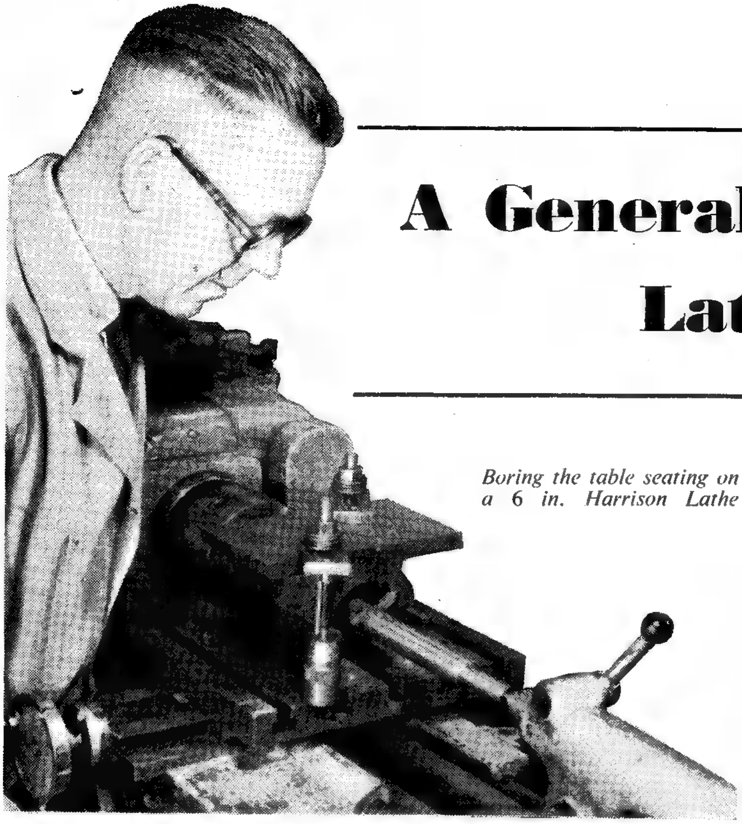
The story of the Talyllyn Railway, its near-decease and its almost miraculous revival under the auspices of the Talyllyn Railway Preservation Society, has been the subject of some publicity in the Press, over the radio and on television, at various times during the past two years. But a detailed description of how the idea of the T.R.P.S. was conceived, and the various negotiations which led to the formation of the society, is not nearly so widely known. This fascinating book comes to fill the gap; it presents us with a complete record of the behind-the-scenes events which led up to one of the most romantic railway events of modern times. It is a story of courage, perseverance and enterprise, supremely refreshing at the present moment, when the interest in the three qualities mentioned seems to be largely a matter for derision and even of scorn. For it is Mr. Rolt's own personal experiences that are here recorded; and, while they give heart to the older reader, they must surely serve as an inspiration to the younger generation and help to rekindle the spirit of adventure rather than to stimulate a desire to laugh at things which seem out-of-date.

As Mr. John Betjeman states in the excellent foreword, the book will appeal chiefly to railway enthusiasts; but it is in no sense a technical book, and this fact, coupled with the extremely varied and intrinsically interesting nature of the five chapters, should ensure for it a very wide circle of readers. Chapter 4 alone gives the reader plenty to think about; it deals chiefly with the 87-year-old engine No. 2, *Dolgoch*, which is still in running order and, moreover, carries her original boiler! If by any chance this old engine should survive until 1966, and then be able to celebrate her centenary by running a special return trip over the little 7-mile railway that she will have served faithfully and regularly for one hundred years, it will be an event without parallel in railway history, a tribute to the craftsmen who built her and a fitting salutation to everyone whose job it has been to care for her during the whole of that time. It is good to think that there are, amongst us, people who are prepared to make all possible efforts against heavy odds to achieve such a record, as this book makes abundantly clear. Mr. Rolt's rendering of the story, so far as it can go at the moment, covers the entire range of human emotion from gay to not so gay; it is a record of keen enthusiasm, persistence and technical skill which must not be let down by those whose job will be to keep *Dolgoch* "alive" during the next twelve years. The book is something of an epic, and there is scarcely a dull page in it anywhere.

Locomotive and Train Working in the Latter Part of the Nineteenth Century, by E. L. Ahrons, Vol 5. (Cambridge: W. Heffer & Sons Ltd). 131 pages, 6 in. by 9 in. Illustrated. Price 15s. net.

This is the fifth collection of articles reprinted from *The Railway Magazine* and deals with the South Eastern, the London Chatham and Dover, the London Brighton and South Coast, the London and South Western, the Somerset and Dorset Joint, the Metropolitan and Metropolitan District Railways. It contains much joyous reading in the best Ahrons' manner, and should not be missed by anyone who has read and enjoyed the four previous volumes of this series. As a sample of the general style of writing, the opening of the chapter devoted to the South Eastern Railway, could scarcely be bettered: "The South Eastern of twenty-five to thirty-five years ago was a railway combining a number of good features with many exceedingly bad ones, and at one time, in company with its younger Chatham brother and rival, was held in the estimation of the local travelling public to be—. Here the reader had better perhaps choose his own adjectives, of which a choice and lurid selection was at one time to be obtained from most regular passengers on the line, except those connected with churches."

Although the pages of this book are frequently illuminated by passages of quick and even pungent wit, there is little if any exaggeration, while the historical and technical information given is accurate. We advise our readers to obtain the book and revel in it.



Boring the table seating on a 6 in. Harrison Lathe

A General Purpose Lathe

By A.M.I.P.E.

THE tailstock hand-wheel having been chucked, boss outward, faced, bored, and screwed 5 t.p.i. to suit spindle, the boss was turned to fit recess in tailstock casting, and a $\frac{1}{4}$ in. wide $\frac{1}{4}$ in. deep recess cut in the correct position to take the two half retaining plates that hold the wheel in position when assembled. Wheel was then reversed in chuck, held in split brass bush to prevent damages, trued up and finally machined all over and polished.

Saw Table—Hinge Bracket

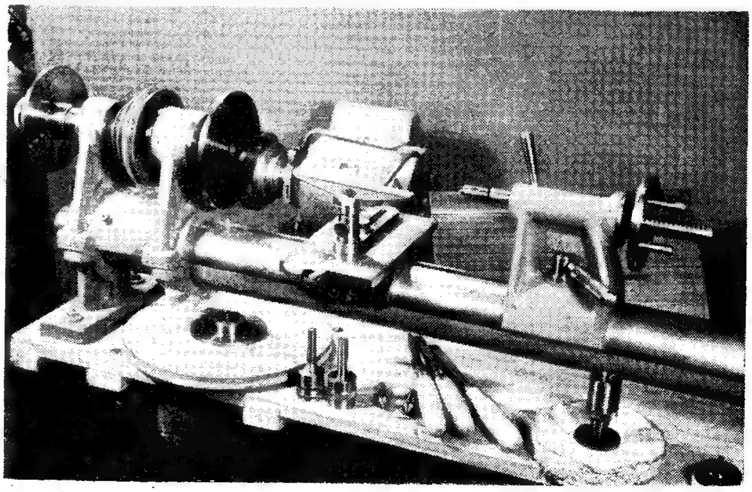
The bracket was a simple milling job with locating step to suit back edge of table, followed by facing boss and drilling and reaming for $\frac{1}{2}$ in. diameter pin.

The table was faced and edges milled square, slotted for saw blade, and milled through, then reversed on mill table and drilled for the bracket pin and again drilled through the smaller boss for the forked end of rise and fall adjusting screw. It was then reversed again on the mill table, and with a vee-cutter, the table was graduated in half-inches, the first line going through central with saw slot. This was to facilitate quick setting of the saw fence. Finally the faces and edges of the table were ground to a good finish.

A $\frac{7}{16}$ in. square length of carbon steel was machined and finally ground to $\frac{3}{8}$ in. square, a good fit in the milled keyway of lathe bed; two pieces were then cut off, drilled and fitted, one to the keyway in the table and one to the keyway under the tailstock, then removed, hardened and refitted. All drilling and tapping was done to fit headstock on the bed, that is, the foot bracket was fitted and the cap of this bracket was fitted to front end of headstock.

The following method was used to line up the headstock with the tailstock, the position of which was, of course, fixed by its hardened key which slid along the keyway in the bed. A dummy spindle was turned and ground between dead centres to fit the headstock ball and roller bearings, with a four-inch length of spindle protruding in the front. This in turn, had been ground a plug fit in the tailstock barrel $\frac{7}{8}$ in. diameter.

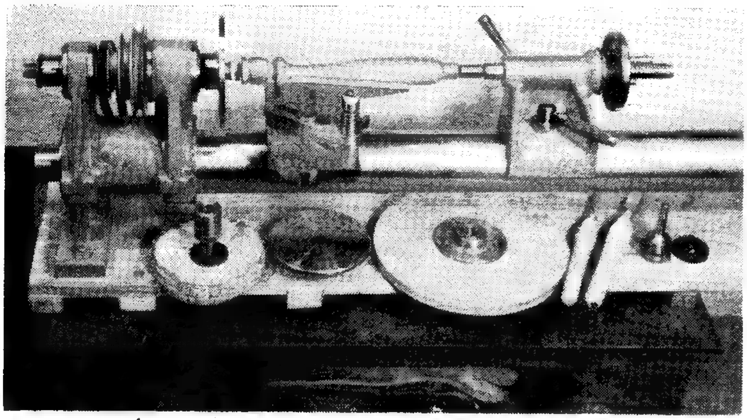
Now the headstock, with its dummy spindle mounted in the bearings, was assembled, and lightly clamped on the bed in its correct position. By gently tapping the headstock either way with a lead hammer, the position was found without difficulty, where by sliding the tailstock forward it located itself exactly on to the dummy spindle for 4 in. with no sign of binding. The headstock finally clamped tight and the tailstock too, a final test was made. By mounting a lathe carrier on the end of the dummy spindle, it was found that it could be smoothly revolved in the bearings



Continued from page 19, January 7, 1954.

of the headstock *and* the bore of the tailstock casting.

Satisfied now with the accuracy attained, the body of the headstock was drilled right through the bed with an electric hand-drill. This hole was reamed $\frac{3}{8}$ in. standard taper, and taper dowel pin turned and carefully fitted with blue marking. The end of this pin was screwed to make extraction easy. This ensured that after removing the headstock for the final assembly with its own spindle, etc., it would go back exactly in the correct aligning position with the tailstock. Complete assembly, not forgetting the vee-belt, was then carried out and presented no difficulty.



The other simple attachments of the lathe need no description or machining; readers can see their build-up from the photographs. The bowl turning end tool-rest was fabricated from channel steel and round material, brazed where necessary, polished up and finally frosted with a hand scraper. Each tool turning rest is interchangeable.

Grinding Wheel Arbor

Bored and screwed to fit left-hand thread on rear of spindle. The $\frac{1}{2}$ in. diameter spindle again screwed left hand to carry a 6 in. wheel.

Buff Arbor

Made to suit spindle, and screwed 12 t.p.i. left-hand taper thread to hold buff. (See photograph.)

Disc for sander turned from $\frac{3}{4}$ in. thick plywood after mounting it on a steel boss screwed to suit rear end of head spindle.

Saw Arbor

Is Morse taper one end to fit head of machine, and secured by draw bolt through the hollow spindle. Tail end is $\frac{5}{8}$ in. diameter, running in a bronze bush in steel shell. Morse taper end fitted to tailstock spindle. Bronze bush has oil hole and left hand spiral groove to throw any oil to the back of bush. Saw table, arbor and saw can be removed in 30 seconds.

Stand and Motor Drive

The eight stand legs are hardwood 2 in. × 2 in.—side rails mortised and tenoned—front rails dovetailed.

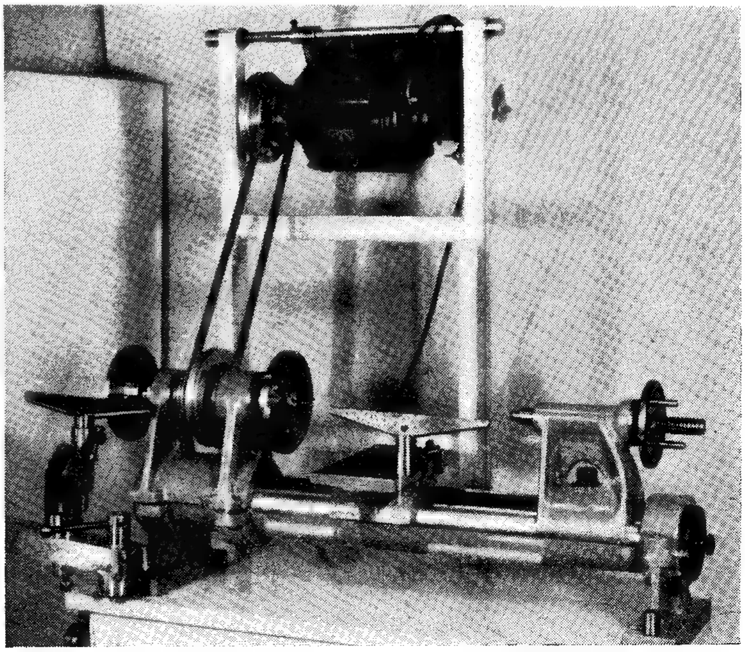
The cabinet stand has fine storage capacity, including four drawers, and two cupboards; notice the well in the top where shavings are brushed and fall into the central drawer, and the recessed tray underneath where tools can be laid whilst working. The stand has eight hard rubber feet, one on each leg in contact with the floor. Motor drive is simple and effective; the motor is hinged and swings on a $\frac{1}{2}$ in. diameter steel bar, and belt tension is adjusted by knurled screw and slotted arm. Soon I hope to design and make a compound tool rest to fit on the table, and perhaps more of this later.

The lathe has proved a great success, and worth the two years part-time work that was needed to complete it. The writer was fortunate that he had access to a small but well equipped workshop.

If you live in the town, one way to get access to special machines is to join the workshop class in your local technical school, where you will find ready help, and an instructor in charge who is likely to be as enthusiastic as yourself.

"Time" is a necessity to the craftsman, for what counts in the end is a good job, and it is in that alone, that satisfaction of accomplishment is achieved.

I would like to acknowledge my indebtedness to my colleague and friend Mr. A. Smith H.N.C. for his help in preliminary talks on the lathe, and the design and advice on making the pattern.



The finished lathe and motor drive

READERS' LETTERS

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

GEARBOX FOR LATHE DRIVE

DEAR SIR,—With reference to THE MODEL ENGINEER dated October 22nd, there was a subject on page 476 headed "More Speeds for the Lathe." This has pleased me very much to think someone else has found a use for the gearbox countershaft. This gearbox method has served me very well for the past six years, without the slightest bit of trouble; in fact, it could be said there have been no adjustments to parts, only half a pint of oil about every six months, with everyday turning.

There is much to be said for the gearbox countershaft; it is always there ready for work by moving the gear lever to the position when the speed is known. The biggest advantage is that it can be thrown out of gear without any effort or damage to the box. Even in the highest gear, there has been no difficulty in engaging gear. Mr. Waggot may find it hard going for the ¼ h.p. motor if he is using the gear oil, as it gets very stiff in cold weather; it does throw my ½ h.p. motor overload switch on starting, but if let run for a little while in neutral, just to get the oil moving, it will then take the load.

I made a mounting for the box, so it could be adjusted by two thumb-screws for the mandrel and motor belts. If this idea is of use to Mr. Waggot or others, they will be welcome to a rough drawing.

On reading Mr. Waggot's story again, I am wondering if he has done right by removing the metal from the primary shaft housing, as he should have removed a set of roller-bearings, leaving the ball-race to take the thrust from the mandrel.

I would be very interested to know the results after a running period of a few months. The time spent on this new countershaft will give the owner pleasure and comfort when turning.

Yours faithfully,

Cromer. W. J. CULLEY.

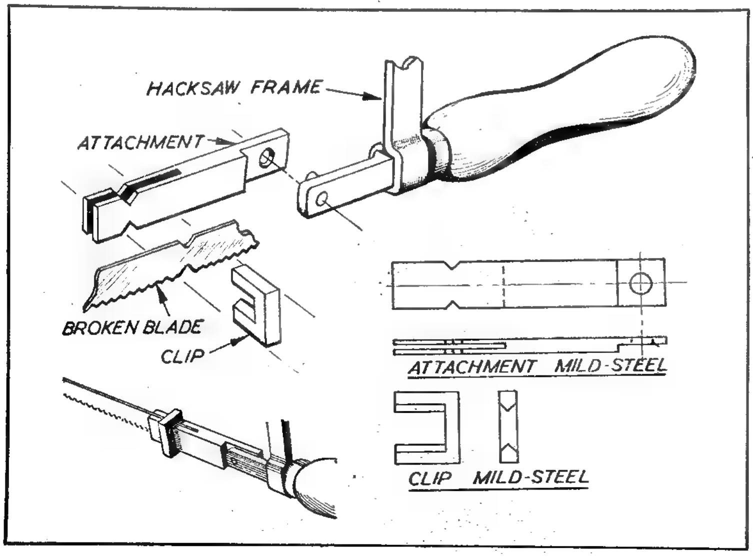
USING BROKEN HACKSAW BLADES

DEAR SIR,—I was very interested in J. E. Priestley's idea for using up broken hacksaw blades ("M.E." October 22nd) and thought an idea of my own which I have used practically for many years may also interest your readers.

The contrivance can use almost any length of broken blade, provided the frame is adjustable. I have used up pieces as short as 4 in. long. It requires no alteration to the hacksaw frame, and the broken blade notches can easily be ground on the corner of the wheel. I have done this with a carborundum stone when a grinding wheel was not available. If both ends are broken, the same idea can be used at either end. The blade can still be used in the normal four positions. The sketches, herewith, are self-explanatory (I hope !).

Yours faithfully,

Wellingboro. J. C. KINGHAM.



STEAM ENGINE VALVE TIMING

DEAR SIR,—I am surprised that your contributors on steam articles put so much emphasis on the lead being equal. Having sailed for a number of years with triple and quadruple engines—*cut-off* was what definitely mattered ! Equal lead does not give equal cut-off.

Yours faithfully,

JAMES HY BRIDSON.

Douglas, I. of. M.

MODEL CAR CONSTRUCTION

DEAR SIR,—Assuming Mr. Pickersgill's letter on Model Cars to be a rejoinder to mine, I really fail to see his point, even as he appears to have missed that which I tried to make.

The question that opened the discussion was "Why the almost entire absence of model cars at the 'M.E.' Exhibition ?" The tone of Mr. Pickersgill's letter seems to answer the question; emphasis on engines and competition: ". . . building i.c. engines for more years than I care to think about . . . pit your own work against commercial jobs . . . to build and race," mention of the trophies, etc.

I share these things with Mr. Pickersgill and have no personal disagreement with his attitude towards them. I too, build engines and race them, and have held two of the trophies he mentions.

Apart from all that, I am endeavouring to answer the original question by attempting to air the other man's point of view, and by "the other man" I mean the fellow who *would* build a car, but for some reason is discouraged from doing

so, or who *has* built a car which has never run through lack of facilities.

The four trophies mentioned are run at two meetings, one north and one south.

My hypothetical model engineer builds a car; whether or not he uses a commercial engine is entirely beside the point. He then looks around for an opportunity to run it. He finds that he has two opportunities a year, or only one if he cannot afford to travel the length of the country. Even then he has to present his untried model before a galaxy of stars. Most discouraging! Or perhaps he becomes aware of the position earlier, and the car is never built. I ask, not participants in the game, but those who would like to enter the game. "Does that answer our original question?"

Yours faithfully,
A. F. WEAVER.

BOILER JOINTS

DEAR SIR,—It was a pleasure to read Mr. White's article, and to see exploded once and for all the report that brazing and silver-soldering cannot be done with an oxy-acetylyne torch if due appreciation is given to the intense localised heat of the flame, and also that some of the "tectics" are better than most people had reported.

However, I would like Mr. White to take the subject on even further and deal with the flame, as the setting of this plays an important part in the success of the joint, and this is not always appreciated.

Yours faithfully,
Maidenhead. D. G. WEBSTER.

2¼ INCHES TO THE FOOT

DEAR SIR,—With regard to the use of 2¼-in. scale by Mr. H. Slack in building his roundabout ("Smoke Rings," 3/12/53), the answer is easy! He used this scale because he wanted something bigger than 1½-in. scale, but smaller than 3-in. scale. In other words, his reason was the same as anyone else's for using any scale—he chose that which suited his resources and gave the size of model he wanted!

Actually, of course, 2¼-in. scale is as convenient to use as ¾ in. or 1½ in.; a little thought will show that 9/4 *can* "be easily converted into twelve equal parts to give scale inches." A scale inch then becomes $\frac{3}{16}$ in., so that one need not even make a special scale rule. Far better than playing about with 12ths or 24ths!

Yours faithfully,
"NORTHERNER."

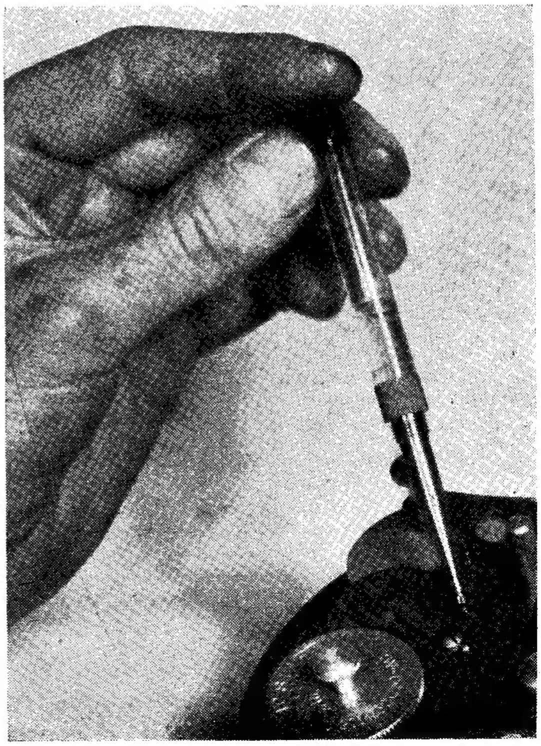
Trade Topics

An Ingenious Lubricator

In the lubrication of small machinery, it is often difficult to apply the oil exactly where required, and at the same time avoid wastage, which is not only messy, but also attracts dust and dirt which may cause subsequent trouble. A very useful appliance for this purpose, known as the "Clearflo" oiler, has been introduced by Messrs. B. & R. Elliott Partners, Union Road, West Croydon, who have submitted a sample for our inspection. It is about the size of a small propelling pencil, and is made in plastic material with a transparent oil container and a metal nozzle containing a hollow needle and a spring-loaded ball-valve. When the needle is placed on the spot where oil is to be applied, and the oiler depressed, a small bead of oil is ejected; if a larger quantity is required, the process can be repeated as many times as necessary. The appliance is supplied with a plastic base which can be used as a bench stand for the oiler, and tubes of special oils suitable for clocks and other mechanism are available; it is well adapted to the application of graphited lubricants.

Electrical Bargains

Messrs. H. Franks of 58, New Oxford Street, London, W.C.1, have submitted for our inspection three items, selected from their extensive range of ex-service goods, which we think will interest many of our readers. The first of these is a miniature delay-action timer, actuated by a clockwork mechanism, and capable of releasing either an electrical or mechanical control at any period up to a maximum of five minutes. It is robustly made, but of light weight, and could be used as a time-limit switch for model aircraft. a delayed camera-shutter release, or for process timing of any kind within the above limit. This device is priced at 4s.



The second item is a heavy-duty push-button switch, suitable for either closing or breaking a circuit, and provided with robust contacts which will carry heavy currents. It is housed in a moulded bakelite case with the button sunk well below the surface and protected by a spring flap. In addition to its obvious uses in alarm or signalling circuits, it could also be used as a circuit breaker for motors or other apparatus, and is sufficiently weatherproof for outdoor use; the price is 2s.

Thirdly, a complete switchbox or control panel in moulded bakelite, carrying two enclosed variable rheostats (of different values), two socket connectors, one having five pins and the other two pins, also a two-way tumbler switch. Either of the components can be detached and used separately. It could be adapted for use as a control unit for electrically-driven model railways and similar apparatus, battery charging circuits and many other experimental devices, and represents good value at 5s. complete.

MOUNTING A SMALL ELECTRIC MOTOR

By "Duplex"

SOME of the small surplus or second-hand electric motors now offered for sale are not fitted with a base mounting, although the body of the machine may be drilled for attaching a fitting of this kind. The that the centre-lines of these screw-holes should correspond as closely as possible to those already drilled in the motor body. One way of measuring the distance apart of the latter screw holes is to set the calipers to contact the outer diameters of the two screw shanks, and then to subtract the diameter of one screw. As a check, it is advisable to set the dividers to the calculated dimension and then to scribe the two centres on a piece of plate; if clearing-size holes are now drilled at these marks, the plate can be tried in place on the motor to make sure that the screws will enter without binding.

After any necessary correction of the setting of the dividers has been made, the work-piece is marked-out and the holes are drilled and counter-drilled on the under side to accommodate the screw heads. To enable the work to be securely held while machining the hollow curvature, a service hole is drilled in the centre and tapped either $\frac{1}{4}$ in. or $\frac{5}{16}$ in. B.S.F.

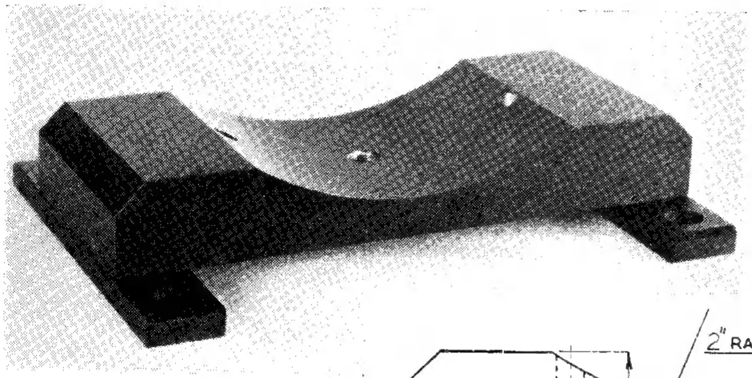


Fig. 1. The finished base mounting

small motor illustrated in a previous article (see the December 31st, 1953 issue), was supplied without a base, but two 4 B.A. holes, 2 in. apart, had been drilled in the body apparently for the purpose of fitting one.

As the motor had to be mounted on a wooden baseboard, it was decided to make a suitable base, and a short length of duralumin bar was chosen in order to ease the work of machining.

An Error Avoided

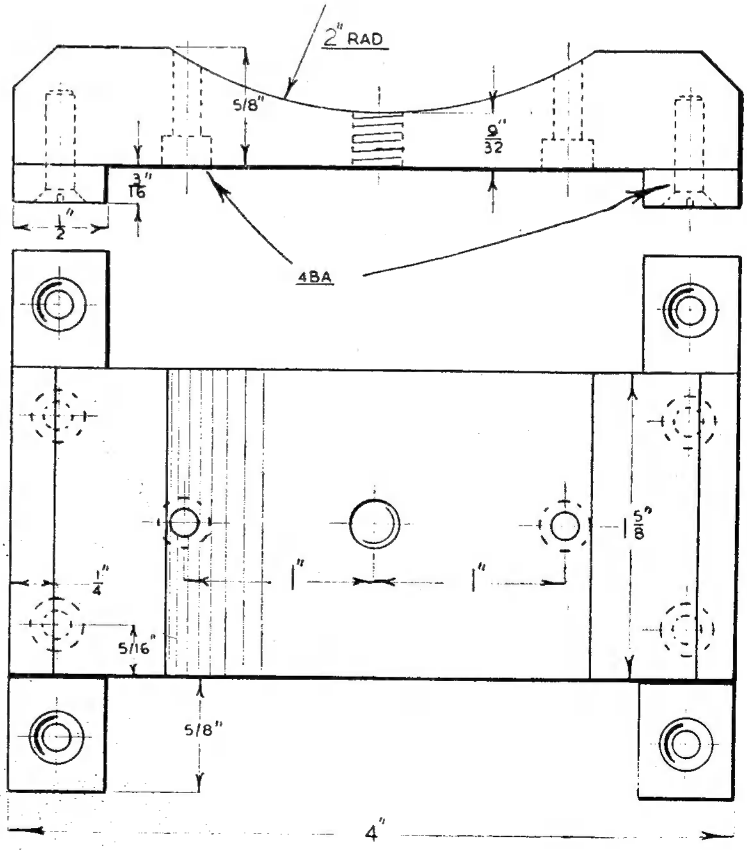
Sometimes the footings fitted to small motors are so narrow that it is not possible to put in wood-screws from above and, instead, it becomes necessary to put in bolts from below the baseboard and fit the nuts and washers on top. In designing the present mounting, care was, therefore, taken to avoid this error and, at the same time, an allowance was made to ensure that the screwdriver did not foul the terminal block attached to the side of the machine.

In marking-out the work, the holes for the two attachment screws are located at equal distances from the centre-line, and it is important

Machining the Curvature

First measure as accurately as possible the outside diameter of the

Below: Fig. 2. Details of the motor base



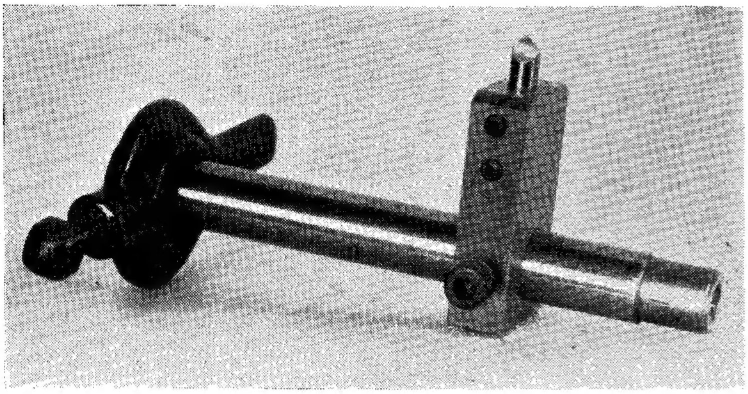


Fig. 3. The fly-cutter made for machining the curved recess

motor body, using the outside calipers and a rule. This dimension was found to be exactly 4 in., as nearly as could be judged. Although we have several adjustable fly-cutters, made in the past for this kind of work, none could be set to a radius of 2 in., and the new cutter head illustrated in Fig. 3 was, therefore, specially made for the purpose. As will be seen, the cutter head is secured to a standard, $\frac{5}{8}$ in. taper mandrel which, when mounted between centres, is driven by means of a carrier from the lathe catch-plate.

The cutter head was machined from a short length of $\frac{1}{2}$ in. × $1\frac{1}{4}$ in. mild-steel bar, and a brass pad was placed under the tip of the Allen clamp-screw to protect the mandrel from injury.

The machining is only a matter of drilling, reaming, and tapping, as will be clear from the working drawing. Drive the mandrel lightly into the cutter head and then tighten the clamp-screw.

The Centre-bit

This is a commercial, short length of hardened high-speed steel, ground at its tip with ample rake to ensure free-cutting. An angle-plate, with its bolting face set parallel with the lathe axis, is next bolted to the cross-slide, and the work is then secured in the vertical position to the angle-plate with a single, hexagon-headed screw; in addition, the centre-line of the work is set at lathe centre height.

Although only light cutting pressure is used during machining, further security against the part shifting will be afforded by bolting a strip to the angle-plate to bear against the side of the work.

Setting the Cutter

Although, to obtain the correct radius, the cutter may be adjusted during the course of the machining by a process of trial and error, there will surely be more satisfaction in making this adjustment correctly at the outset, and knowing that the machined part will fit accurately in place without the need of hand-fitting or the addition of packings. One way, not necessarily the best, of adjusting the cutter is represented in Figs. 5 and 6. Mount the test indicator on the lathe cross-slide, as shown in Fig. 5, and feed the slide forward to bring the indicator plunger into contact with the mandrel at a point where it measures 0.625 in. in diameter; then set both the dial of the indicator and the index of the cross-slide to zero.

As the zero reading of the test indicator now corresponds to a radius of $\frac{5}{16}$ in., the cross-slide will have to be moved outwards a further $1\frac{11}{16}$ in. or 1.6875 in. to make the radius equal to 2 in., measured from the lathe axis.

Therefore, the feedscrew, if of 1/10 in. pitch, is turned outwards for 17 turns, representing 1.700 in. To make the radius equal to 1.6875 in., the slide is finally moved inwards for 12.5 thou. in. Next, as represented in Fig. 6, the cutter is adjusted to make the test indicator read zero when the mandrel is turned by hand to bring the point of the tool into contact with the indicator plunger. Although this description of adjusting the cutter is necessarily somewhat lengthy, in actual practice the setting takes but a few seconds.

Now that the cutter has been set at the required radius, the curved recess is machined by putting on the cut with the cross-slide and traversing the saddle by means of the automatic feed.

Machining is continued until the required depth has been obtained; that is to say, until the arc formed extends to just beyond the line of the holes for the attachment screws.

Checking the fit of the finished part on the motor body showed that there was no rocking, and no daylight could be seen through the joint. To

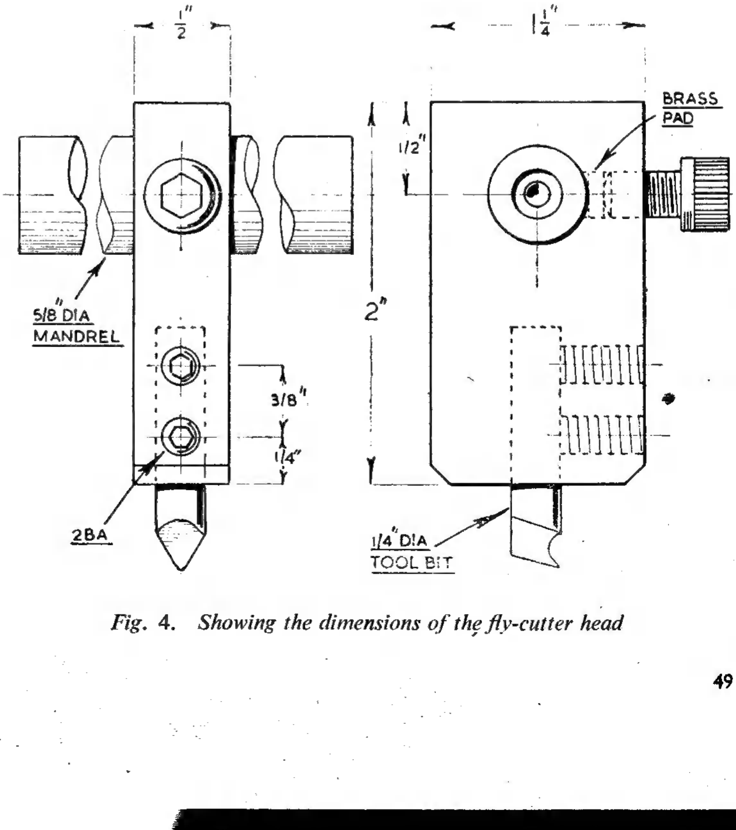


Fig. 4. Showing the dimensions of the fly-cutter head

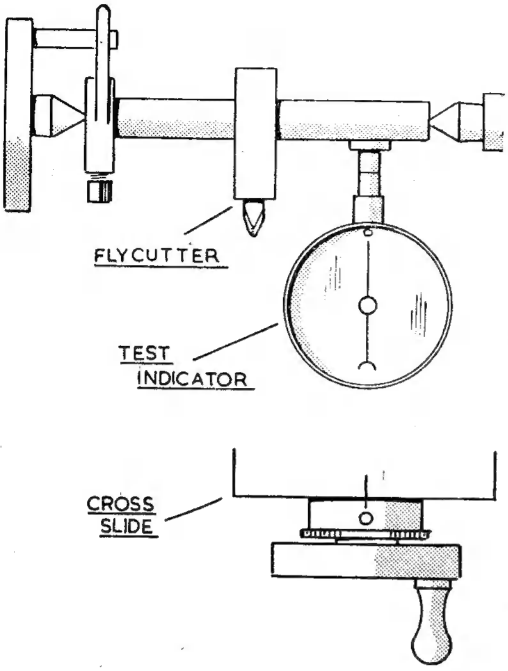


Fig. 5. Obtaining the zero setting of the cross-slide and test indicator

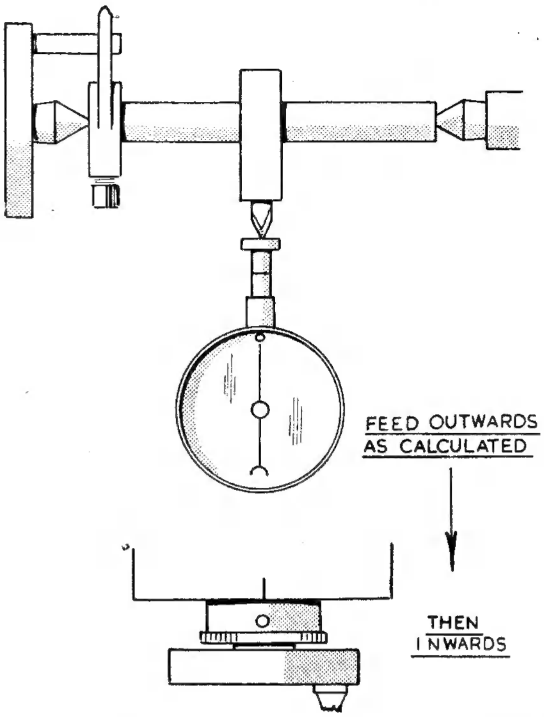


Fig. 6. Adjusting the cutter after resetting the cross-slide outwards

finish the job, the strips shown in the drawing are secured to the ends of the base with countersunk screws. With a motor body 4 in. in diameter, it was found that the screwdriver would readily engage the holding-down wood screws if the hole centres were spaced 3½ in. apart.

Try the assembly on the surface plate and, if rocking is present, the under side of the base must be filed until this movement is eliminated. Finally, give the base a coat of instrument black to match the rest of the motor.

BRITISH CRAMPTON LOCOMOTIVES

(*Continued from page* 39)

Cylinders 16 in. diameter by 20 in. stroke. The heating surface was: Tubes, 861 sq. ft.; firebox 59 sq. ft. Total 920 sq. ft. The grate area 14.5 sq. ft. The working pressure appears to have been no more than 50 lb. per sq. in., no higher than the first Cramptons of 1846. The weight was 25 tons 18 cwt.

The colour of the paintwork is unknown; it is more than likely that it was, in the main, green with possibly red frames. Locomotive builders in those days had great influence in deciding the colour and style of painting and some, if not all of the engines of E. B. Wilson and Co. were a deep shade of middle chrome green, on boiler lagging and other platework, on the fluted portions and bases of the dome and safety-valve casings and on the wheels and springs. On the frames, a rich crimson red. Details of the picking out and fine lining are unknown but it was probably in black and white. Panel bands had corners radiused inwards.

The hemispherical top of the dome and the bell-mouth of the safety-valve case, as well as the front and back corners of the firebox lagging were all of polished brass. The chimney top was of bright copper.

On these Aberdeen Cramptons the driving wheel splashers were, like those of the Eastern Counties, of brass and the leading wheel splashers had a band of brass on the outer edges. After the alteration to the valve-gear the driving splashers appear to have been partly closed in with slotted plates as drawn by Mr. Ward.

The writer ventures to think that most of his readers will agree with him in the opinion that these two Aberdeen engines were the prettiest Crampton locomotives that were ever built, either in this country or on the Continent.